Design, Construction, Operation of Metal-Working Equipment and Manufacture of Metal Products

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Better Threads by Landis Methods

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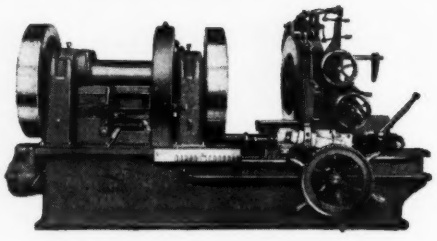
CUTTING

Bolt and Pipe Threading Machines. Threading Heads for Turret Lathes and Automatic Screw Machines. Equipment designed either for high production work or for jobbing and maintenance operations. An important feature of this equipment is that it uses the Landis Tangential Chaser, whose free cutting action has often caused it to be acclaimed "The Finest Thread Cutting Tool in Industry."



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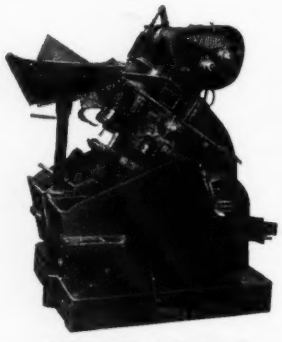
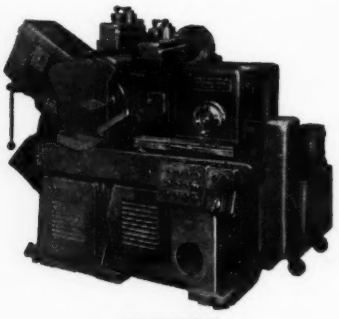
The Centerless Thread Grinder for grinding screw threads on straight cylindrical workpieces and headed or multiple diameter parts by either the thru-feed or in-feed methods. It can be used for grinding threads from the solid as well as for finish grinding of precut threads, the choice of method being determined by the workpiece and thread specifications.



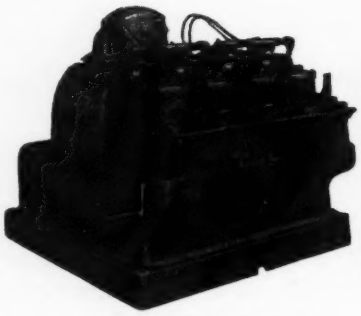
AUTOMATIC FORMING & THREADING MACHINE



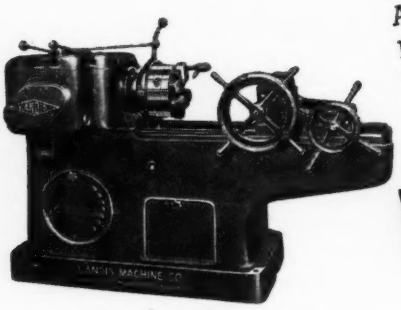
CENTERLESS THREAD GRINDER

ROLLING

A fast and economical method of generating screw threads. The Landroll Attachment, for producing straight threads, is designed for Automatic Screw Machines. It provides for processing threads which would otherwise have to be handled as a secondary operation.



4-SPINDLE SEMI-AUTOMATIC



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Collapsible and Solid Adjustable Taps for tapping straight and tapered threads—held within National Screw Thread and API tolerances.

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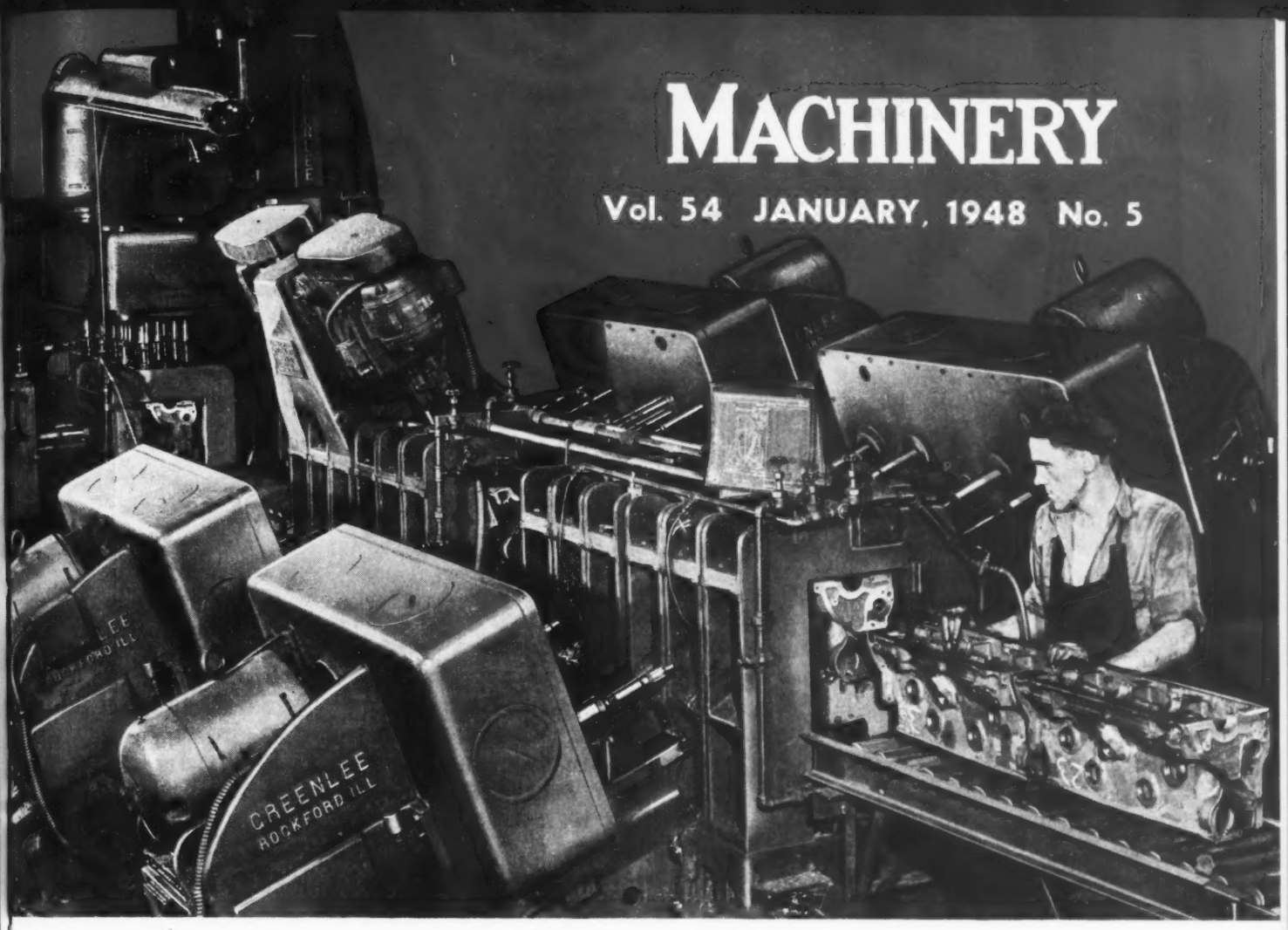


Producing the New Studebaker

By GEORGE E. WESTPHAL
General Factory Superintendent
The Studebaker Corporation
South Bend, Ind.

A CAR of revolutionary new design was developed by the Studebaker Corporation in reconverting from war to peacetime production. So completely different was this automobile from previous models that the development of the design, the installation of new equipment, and the adaptation of old equipment to meet the production requirements involved an expenditure of over $20,000,000. Some of the new manufacturing methods adopted in order to attain the current production of more than 3100 cars and 1600 trucks a week are described in the following.

The bearing lock surfaces, manifold and valve cover face, and top and bottom surfaces of Studebaker cylinder blocks are rough- and finish-milled in one set-up on an Ingersoll eight-spindle, four-station, traveling-head machine. A production of sixty blocks per hour is attained by a single operator. Fig. 1 shows the operator transferring blocks to the loading station at the front.

The block is placed in the loading station on its side and is located on four pads that have been previously milled on the back of the block. It is then hydraulically clamped in place. There are seven blocks in the machine at one time. At the end of a cutting cycle, the blocks are all transferred to the next station, a completed block being ejected onto the conveyor and an unmilled block being loaded at the first station. The transfer mechanism is operated by one of the traveling heads.

Fig. 1. Loading Station of Eight-spindle, Four-station, Traveling-head Machine Employed for Milling Cylinder Blocks

At the first station, a 10-inch diameter twenty-six blade horizontal milling cutter, mounted on a traveling head, removes from 1/8 to 3/16 inch of stock from the top of the block. Mounted on the same head are two 10-inch diameter vertical cutters which rough and finish the manifold face. About 0.035 inch of stock is removed in the finishing operation. The three cutter-spindles are driven through gears from a single 50-H.P. motor, and the entire head is fed past the blocks mechanically at the rate of 48 inches per minute.

The second traveling head, shown at the right in Fig. 2, is equipped with four cutter-spindles, all of which are driven from a 40-H.P. motor. Two 10-inch diameter cutters with twenty-eight blades each are used to rough the upper and lower pan rails. A single 12-inch diameter cutter with thirty blades (shown in the foreground) finishes both pan rails. The bearing locks are milled by a ten-blade cutter. A cutter mounted on the third head, and driven by a 15-H.P. motor, finish-mills the top of the block. This cutter is 10 inches in diameter and has twenty-four blades.

One feed-box operates all three traveling heads simultaneously, providing a cutting feed of 48 inches per minute and a rapid traverse for the non-cutting cycles. The milling cutters, all of which are carbide-tipped, are rotated at 180 surface feet per minute for the roughing cuts and at 280 surface feet per minute for the finishing cuts.

The control board, which contains a jeweled light for each critical position on the machine, indicates when all clamps, locating fingers, etc., are in their proper positions. A conveyor type

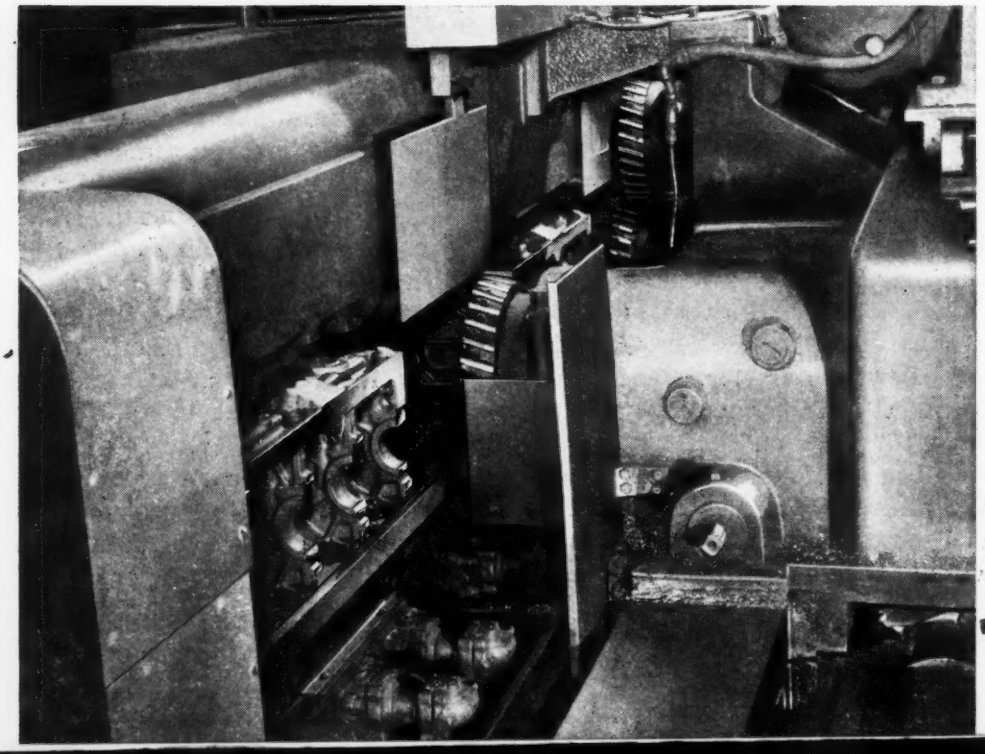


Fig. 2. The Second Traveling Head of the Milling Machine Shown in Fig. 1 Carries Four Cutters for Milling the Pan Rails and the Bearing Locks

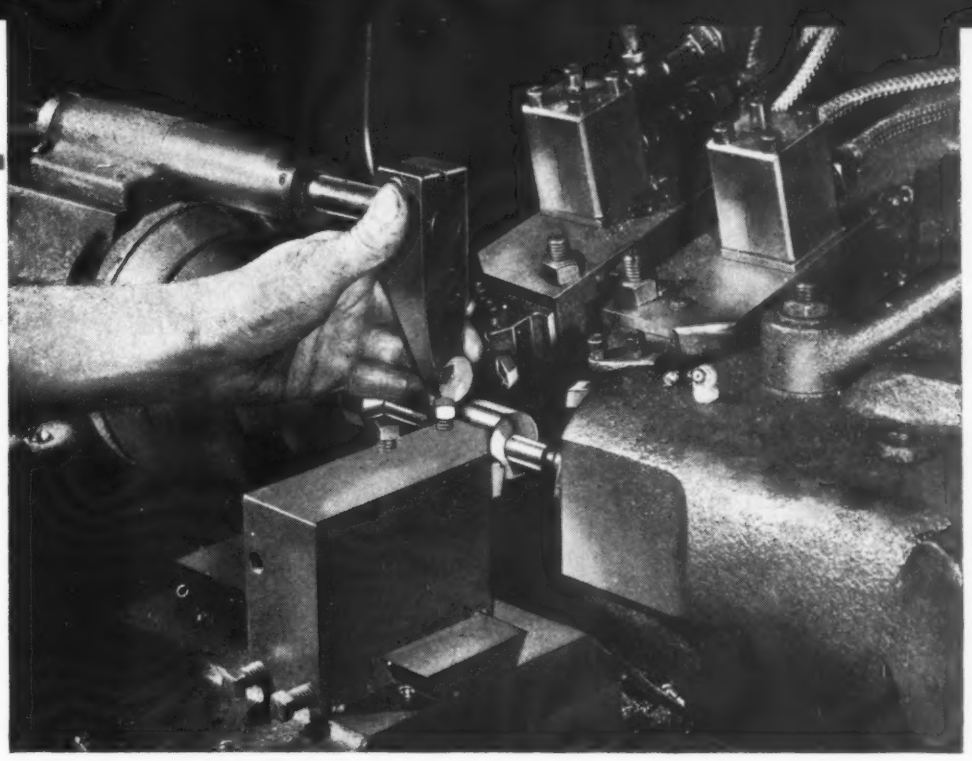


Fig. 3. The Work, Pressed on an Arbor, is Located Axially in the Chuck of This Lathe by Means of a Swinging Stop

chip disposal unit removes chips from the pit below the cutters and empties them into a trailer at the front of the machine.

Another high-production machine in the cylinder-block line is the Greenlee two-way four-station transfer machine shown in the heading illustration. Eight drills and four reamers are fed hydraulically at various angles to complete the distributor pad and oil-pump holes, the production being sixty blocks per hour.

Oil-pump idler-gear blanks that were formerly ground to finish dimensions are now turned to length and diameter within plus or minus 0.0005 inch on the "Lo-Swing Imp" automatic lathe shown in Figs. 3 and 4. After drilling and reaming the bore and chamfering both ends of these parts on multiple-spindle automatics, a keyway is broached through the bores.

Each blank is then forced on an arbor by means of a hand-operated press for the turning and facing operations. Since the position of the blank on the arbor varies with the pressure exerted on it, the arbor is located in the air-operated chuck of the lathe by bringing one face of the blank into contact with a swinging stop, as seen in Fig. 3. This locates the part in the correct position relative to the two carbide-tipped, single-point straddle-facing tools mounted on the inclined rear slide of the lathe.

About 1/64 inch of stock is removed from the outside diameter of the part by the turning tool on the front slide, thus finishing the blank to a diameter of 1.3255 inches. The facing tools are then fed into the work, removing about 1/64 inch from each face and finishing the blank to a length 1.5005 inches. The work is rotated at 500

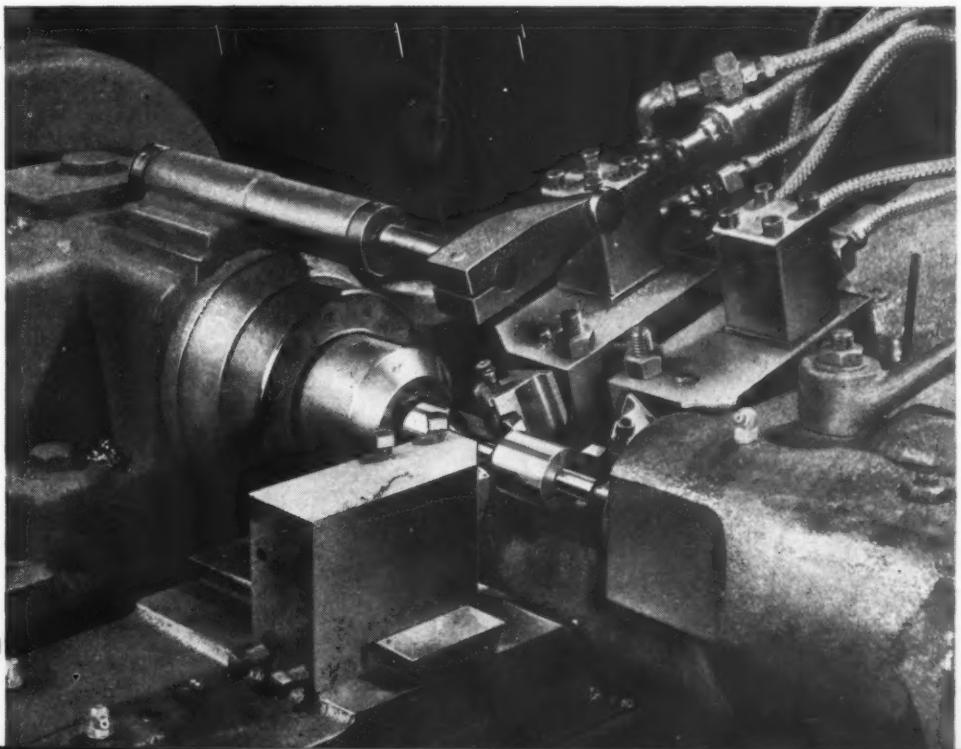


Fig. 4. After the Straddle-facing Operation, the Tool-blocks on the Rear Slide are Pneumatically Tipped away from the Work to Prevent Scratching

surface feet per minute, and the tools are traversed at the rate of 0.004 inch per revolution. A production of ninety-five parts per hour is obtained.

At the completion of the straddle-facing cut, a pneumatic device tips the tool-blocks 30 degrees from their horizontal position, as shown in Fig. 4, so that the tools will not mark the finely finished faces when they are retracted to their original positions. A hand-lever and cam-operated tailstock facilitate loading. The collet is ground to arbor size to minimize run-out and insure accuracy.

Loading, clamping, and unloading of an unwieldy part for a drilling and tapping operation are facilitated by the use of chutes and a four-station indexing fixture, as shown in Fig. 5. The support arm brackets which are to be drilled and tapped are made from hot-rolled steel stampings, 3/16 inch thick, which are formed into a U-section, with washers welded to each side. The formed brackets are loaded into the chutes behind the operator. The operator unloads three finished parts and clamps three new parts by hand into one of the four stations, at the upper left-hand side of the fixture. The fixture is then indexed manually and the process is repeated.

Indexing on this Baker two-way, multiple-spindle drilling and tapping machine is counter-clockwise as viewed in the photograph. At the lower left-hand station, the in-line holes of the stamping and washers are drilled to enlarge their diameter from 13/32 to 19/32 inch. Six drills, three from each side, are fed hydraulically into the three parts. At the lower right-hand station, six chamfering tools, three from each end, machine a 45-degree chamfer on the outside of each hole.

At the upper right-hand station, three taps are fed from a head at the far end of the machine through both sides of each part. The 5/8-inch taps are provided with a step so that the root diameter of the thread on one side of each part is 0.010 inch larger than the other. This allowance is made to facilitate fitting of the shackle bolt when the part is assembled. Support arm brackets are drilled and tapped at the rate of 310 per hour with this equipment.

Fig. 7 shows a broaching operation on the upper arm supports for steering-knuckle pins. About 3/32 inch of stock is removed in a single operation from four surfaces, 90 degrees apart. A Cincinnati hydraulic 20-ton broaching machine is used for this job. The work-pieces are forged from SAE 1040 steel, and are made in both right- and left-hand styles. One style of support is broached on one ram while the other is machined on the second ram of the duplex machine.

Fig. 5. Support Arm Brackets are Drilled and Tapped at the Rate of 310 per Hour on a Two-way Multiple-spindle Hydraulic Machine

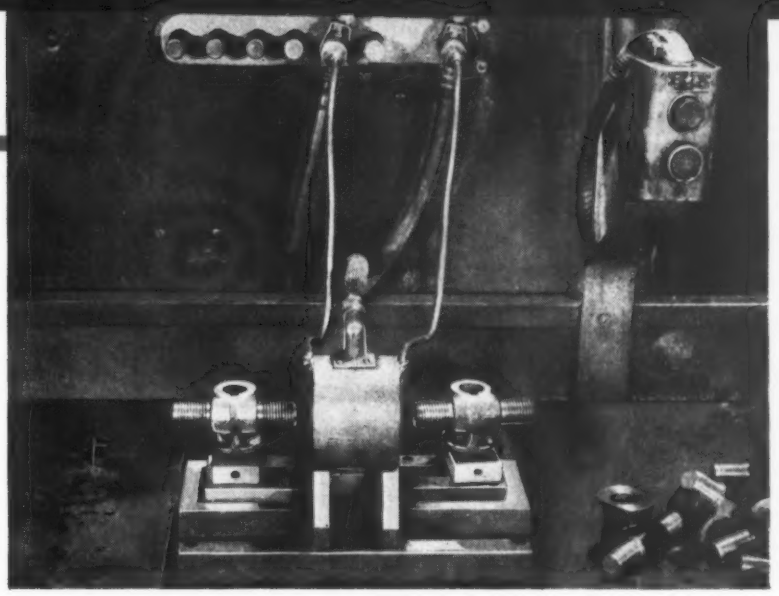


Fig. 6. Set-up for Induction Hardening of Threads on Support Arms. A Minimum Hardness of 52 Rockwell C is Obtained

A hydraulically operated swiveling fixture permits loading and unloading one side while broaching a part with the opposite ram.

For the operation, the part is held between a pair of V-blocks. The upper V-block is brought down to clamp the part by a manually operated, screw actuated lever arm. Four broaches, spaced 90 degrees apart, are mounted in the holder on each ram of the machine. The broaches are 37 inches long, and are made in four equal sections. They are fed hydraulically past the work at the rate of 40 feet per minute. More than 240 support arms per hour are broached in this set-up.

After performing several conventional machining operations on the broached upper support arms, including the threading of two of their projections, they are induction hardened in the set-up shown in Fig. 6. The threads on the arms are the only parts that have to be hardened, as the other surfaces are not subject to wear. Two parts are handled simultaneously by sliding the anvils on which the parts are held along a keyway toward the multiple-turn coil shown in the center. After the threaded portion on one projection of the parts has been heated and quenched, the parts are retracted, swiveled through an angle of 180 degrees, and reinserted in the coil to harden the threads on the other projection. With this arrangement, a production of 240 arms per hour is attained.

Induction heating is employed on this particular part instead of hardening in a cyanide bath because of the close tolerance (0.0005 inch) to which the keyed bore has been machined. With induction heating, practically no distortion or change in size is encountered. The full power of the 15-K.W. General Electric electronic heater employed for this operation is utilized. Each pair of threads is heated for seven seconds and quenched with a spray of water for four seconds. A minimum hardness of 52 Rockwell C, penetrating to the root of the thread, is obtained.

Another part that is induction hardened is the S A E 1042 steel flywheel starter gear shown in

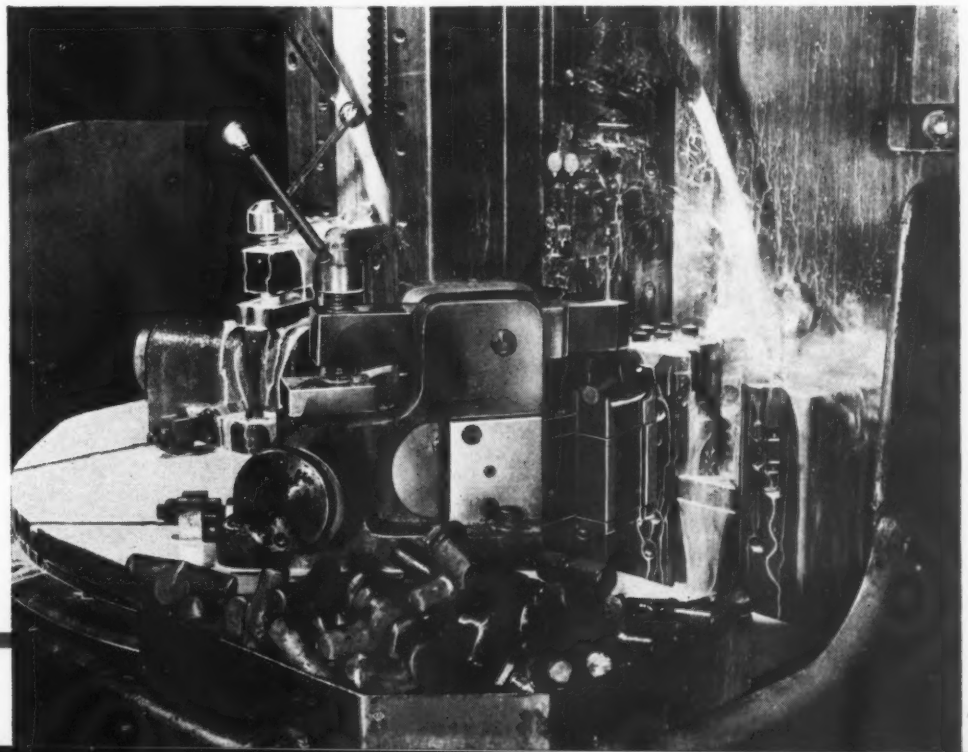


Fig. 7. A Swivel Fixture on a Duplex Broaching Machine Permits Loading of Work at One Side while Broaching a Part with the Other Ram

Fig. 8. In this case, an increase of three times in the life of the gears has been noted over gears that were hardened conventionally, quenched in oil, and drawn. Also, the drawing operation has now been eliminated, since only the teeth of the gear are heated, resulting in an increased production of 180 per hour. Warpage, scale, and change of size have been practically eliminated. With this method of hardening, a 0.006-inch maximum run-out of the 12.386-inch pitch diameter relative to the inner diameter of the gear can be maintained.

The gear to be hardened is rotated on a fixture within the heating coil of a General Electric 50-K.W. electronic machine. Rotation is necessary to insure uniform heating of the surface of the teeth. A heating cycle of fifteen seconds and a water spray quench of seven seconds are required to attain the 48 to 60 Rockwell C hardness required. This hardness is subsequently reduced to from 44 to 52 Rockwell C when the gear is heated to 450 degrees F. for shrink fitting to assemble with the flywheel.

Steering-knuckle support arms and clutch-operating shafts are cyanide hardened at high production rates by means of the Studebaker designed fixture shown in Fig. 9. The process employs a six-sided "merry-go-round" with three racks having spaces between them. The "merry-go-round" is moved vertically on a center post by a manually controlled air cylinder.

As the rack shown in the foreground is being unloaded and reloaded, parts in the second rack (left background) are immersed in the cyanide bath, and parts in the third rack at the right are being quenched in oil. Provision is made in this equipment for varying the depth of immersion to suit the requirements for different parts. Temperature control lights indicate when the fixture should be indexed. The cyanide bath is maintained at a temperature of 1550 degrees F., and the parts are heated to this temperature.

Each rack holds about fifty-six parts, and a twenty-minute cycle is required to load, harden, quench, and unload each rack. A file-hard case, about 0.0015 inch deep, is developed on the S A E 1024 steel support arms. A single operator can attend two fixtures, both of which use a common oil quench tank. In addition to increased productivity, this process offers improved safety conditions, since the operator is kept away from the cyanide baths.

The engine and transmission faces of cast-iron clutch housings are ground on a three-spindle Hanchett grinder, as shown in Fig. 10. About 0.060 inch of stock is removed from each face of the housing, the parallelism of the faces being maintained within 0.003 inch.

The cast housings are clamped manually to the fixtures on the rotary table. Eight fixtures are provided, four to hold the housings while grinding the engine face, and the other four to hold them while finishing the opposite surface. Each of the three vertical heads on the machine is driven directly by a 30-H.P., 880-R.P.M. motor. An eight-segment wheel is bolted to the bottom face of each spindle.

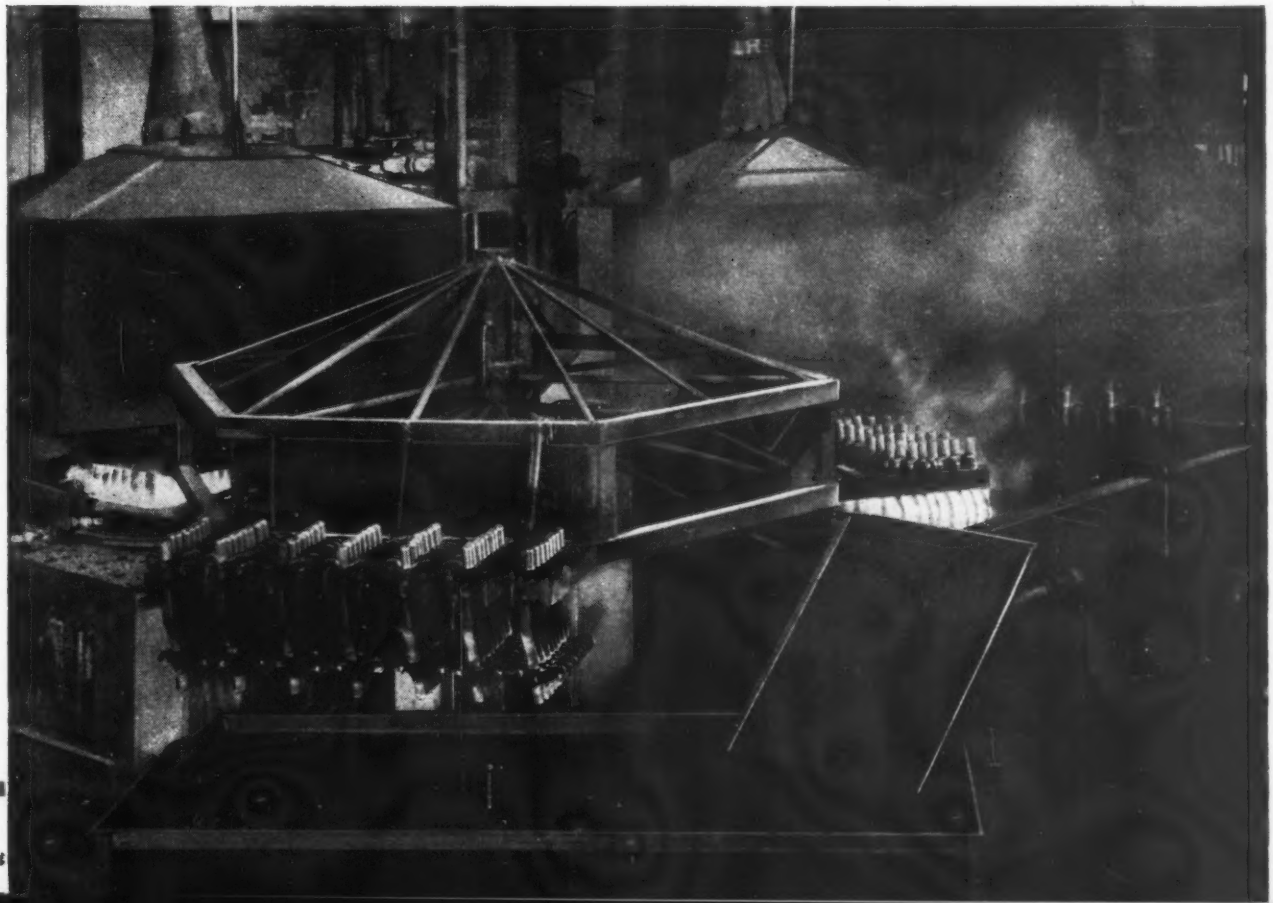
Fig. 8. The Life of Flywheel Starter Gears has been Increased Three Times by Means of Induction Hardening

Fig. 9. (Below) "Merry-Go-Round" Fixture for Cyanide Treating and Quenching of Automotive Parts on a High Production Basis

Fig. 10. (Right) Three-spindle Vertical Surface Grinder for Finishing Both the Engine and Transmission Faces of Cast-iron Clutch Housings

As the work rotates with the table, it first passes under the wheel-head shown at the right. Here 0.025 inch of stock is removed by a 12-grit silicon-carbide abrasive wheel. Beneath the second head, another 0.025 inch of stock is removed by a similar wheel. Finally, under the third head (seen at the left) about 0.010 inch is removed by a 30-grit silicon-carbide wheel. The part is then unclamped and reloaded on one of the other type fixtures for grinding the opposite face. The rate of production attained on this job is eighty clutch housings per hour.

The feed of the grinding wheel is automatically adjusted for wheel wear by a separate motor-driven mechanism. Each wheel is independently lowered in increments of 0.0005 inch, as determined by a sizing gage which indicates the wheel wear. As a further means of increasing the automatic operation of this machine, an ammeter is mounted on each grinding wheel head. By observing the readings on these ammeters, the operator can tell at a glance whether all the wheels are cutting properly and whether each is taking its proportionate share of the cut.



Lubrication Factors

Proper Consideration of Lubricating Techniques in Designing Bearings for Industrial Applications Eliminates Difficulties in Operation and Increases Bearing Life — Prepared by Industrial Division Technical, Socony Vacuum Oil Co., Inc.

THE primary objective of bearing lubrication is to maintain a film of lubricant between the rubbing surfaces so as to prevent surface contact, with its attendant wear. In some cases, however, other functions of lubricants, such as removal of induced heat, protection of surfaces from corrosion, and sealing out of abrasive particles, may be of equal importance.

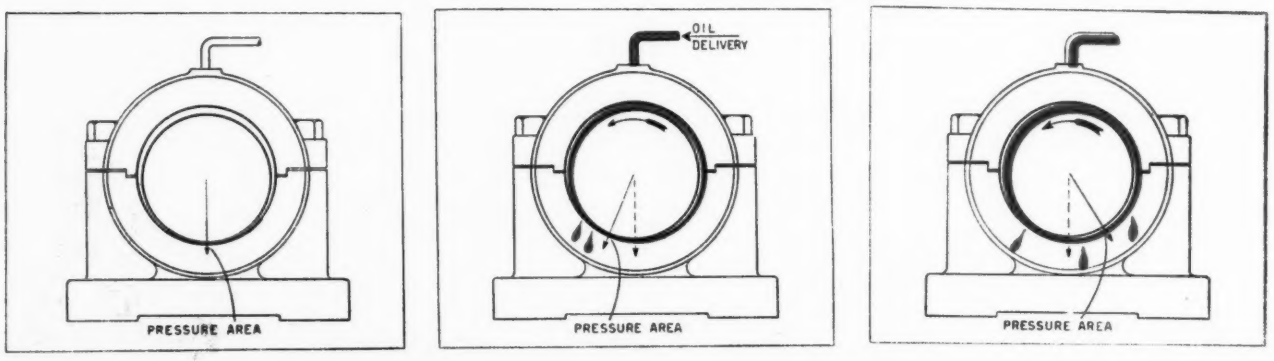
Bearings may be broadly divided into two classes—"plain" and "anti-friction." Both classes can be designed for either oil or grease lubrication. Generally speaking, oil provides the best lubrication, but in many applications certain characteristics of grease outweigh other considerations. The choice of oil or grease is determined by operating factors and maintenance considerations.

When an oil of correct body is supplied in sufficient quantity to keep the clearance spaces of a plain bearing flooded, or at least partially flooded, the rotating journal draws a wedge of oil into the pressure area. Thus hydraulic pressure is developed which supports the load, and the bearing and journal surfaces are completely separated by a full fluid film of oil, as shown in Fig. 1.

The hydraulic pressure generally is high along the length of a bearing, but falls off rapidly at the ends because of oil leakage. This pressure distribution is one of the factors that determine the minimum length-to-diameter ratio of the bearing. In the direction of the oil wedge, the pressure rises rapidly from the incoming side, reaches a maximum just ahead of the thinnest part of the wedge, and then decreases abruptly. Any grooving of the bearing in the pressure area would permit flow of oil to areas of lower pressure, and thus reduce the load-supporting ability of the oil wedge.

Grooving outside the pressure area is usually required for oil distribution along the length of the bearing, but generally no other grooving is

Fig. 1. Diagrams Illustrating the Oil-wedge Principle. (Left) When a Machine is Idle and the Journal is at Rest, the Lubricating Film is Squeezed out of the Pressure Area by the Weight of the Shaft and the Consequent Pressure of the Journal. Leakage from the Ends of the Bearing Leaves Very Little Lubricant in the Clearance. At This Time, there is Actual Contact between the Journal and the Bearing. Arrow Indicates Weight of Shaft, as well as Direction of Pressure on the Bearing. (Center View) When a Machine is Started up, Oil is Delivered Automatically to the Bearing, a Wedge of Oil thus being Formed in the Clearance Space. Due to High Starting Friction, the Journal Momentarily Rolls up the Side of the Bearing. However, the Shifting of the Shaft Brings the Oil-wet Surfaces of Both Journal and Bearing into Contact and Immediately Results in Slippage. Dotted Line Indicates Weight of Shaft, and Full Line Pressure on Bearing. (Right-hand View) At Full Speed, the Revolving Journal Draws Oil so Rapidly into the Pressure Area that the Resulting Hydraulic Pressure of the Oil Wedge Actually Crowds the Journal toward Other Side of Bearing. Dotted Line Indicates Weight of Shaft, and Full Line, Direction of Pressure on Bearing



in Bearing Design

needed for lubrication purposes. On the other hand, extra circumferential grooves are sometimes required in circulation-oiled bearings to permit the flow of sufficient oil for cooling purposes. These are located outside of the pressure area. Grooves of this type should be well chamfered to remove sharp edges.

Small, annular drain grooves may be provided at the ends of a plain bearing to collect oil and return it to the reservoir. This tends to minimize atomization of the oil leaving the ends of the bearing, and makes it less subject to oxidation from contact with warm air. Where the ends of the bearing must take a thrust load, however, the design should be such as to permit the oil to flow from the end of the bearing, in order to lubricate the thrust surface.

Bearing clearances that are too large permit excessive flow of oil away from the pressure area, and thus require the use of an oil of higher viscosity than would normally be selected for the particular load and speed conditions. On the other hand, the smaller the bearing clearances, the thinner the oil wedge. If too small a clearance is provided, slight deformation of the bearing shell under heavy or shock loads may make the bearing surface so nearly parallel to the journal surface that the formation of a wedge film will be impossible. A common rule-of-thumb for bearing clearances is to allow 0.001 inch per inch of shaft diameter. However, some bearings, such as those on the spindles of precision grinders, are set up with clearances as small as 0.0001 inch per inch of diameter. Such clearances require great precision in the finish of mating surfaces, and great rigidity in the bearing elements.

Misalignment, due to faulty assembly, or excessive deformation of parts under load or temperature results in concentrated bearing pressures and sometimes in rupture of the oil film; this is a frequent cause of bearing failure. Long bearings are more sensitive to misalignment than shorter ones of equal diameter.

In full-fluid-film lubricated plain bearings, the lubricating oil is used over and over for periods ranging from a few months to many years. The constant recirculation of the oil in contact with warm air promotes oxidation, and only oils having high resistance to oxidation are suitable for this service.

Such impurities as dirt, dust, or metallic particles also increase the rate of oxidation and form deposits and sludges that may settle in the oil passages and restrict flow. Hence, shaft seals should be provided, and suitable means, such as filters, centrifuges, or settling tanks, should be incorporated in the lubricating system for continuous or periodic removal of solid impurities. For ring-oiled bearings, where the oil charge is contained within the bearing housing, it is necessary only to provide convenient fittings for inspection, filling, draining, and oil-level control. Oil purification and flushing of bearing housings are taken care of by periodic maintenance.

The speed, load, and clearance of the journal and the viscosity of the oil at the operating temperature determine the thickness of the fluid film that supports the journal. Higher speeds and lighter loads permit using oils of lower viscosity, whereas lower speeds and heavier loads require the use of higher viscosity oils.

The accompanying table gives oil viscosity ranges suitable for plain bearings under ordinary service conditions and under operating temperatures of between 50 and 130 degrees F. Great caution must be exercised in selecting an oil of the proper viscosity, since the effect of bearing clearance, shock loading, or the possibility of imperfect alignment must be carefully evaluated. Where operating temperatures are less than 50 degrees F. or more than 130 degrees F., lower or higher viscosities are required.

For the bearings of many standard machines, the most practical lubricating-oil viscosities have been established through actual experience. Be-

Oil Viscosity Ranges for Plain Bearings

Load, in Pounds per Square Inch of Projected Area	Speed, Revolutions per Minute	Saybolt Universal Viscosity at 100 Degrees F.	
		For Full Fluid-Film Lubricated Bearings (Circulation, Bath, Splash, Ring, or Chain Oiled)	For Boundary-Lubricated Bearings (Hand, Drip, Wick, or Bottle Oiled)
Under 250	Under 50	800–1200	1500–2000
	50–200	550–700	800–1200
	200–2000	275–350	550–700
	2000–5000	140–160	275–350
	Over 5000	55–65	55–65
250 to 1000	Under 50	1500–2000	2200–2800
	50–200	800–1200	2000–2600
	200–750	550–700	1500–2000

cause of conditions peculiar to certain machines, these established viscosities do not necessarily fall within the ranges given in the table.

As will be noted, recommendations also are made in the table for boundary-lubricated bearings, which will be discussed later.

Bearings that are flood lubricated are found in machines in which the oil is applied by circulation, bath, or splash systems, and by ring, chain, or collar oiling (see Fig. 2). Quantities of oil in excess of lubrication requirements are generally provided.

Boundary Lubrication of Plain Bearings

In plain bearings where oil is applied in such a way that the feeds are very restricted—such as by means of wick-feed cups and bottle oilers, or by hand—any excess oil is quickly squeezed out of the pressure area and the hydro-dynamic oil-wedge type of lubrication cannot be maintained. This condition is known as "boundary lubrication." If the oil is of suitable viscosity for ready distribution and is characterized by ability to adhere tenaciously to bearing surfaces, thin separating films can be maintained by these means. While metallic contacts usually cannot be prevented entirely, wear and friction are greatly reduced. Bearings of this type often operate successfully for many years with boundary oil films of microscopic thickness between the bearing and journal surfaces.

In cases of boundary lubrication, the design of the bearing has a very important effect on successful operation. Consider, first, the shaft rotating in the bottom half of the bearing, Fig. 3. The bearing must, of course, be larger in radius than the shaft. In the view at *A*, where this clearance is shown exaggerated, it will be seen that the shaft rests on only a small area of contact in the bottom of the bearing.

To reduce the unit load and thus improve the load-carrying capacity of the bearing, the contact area is increased by scraping the bearing to secure an arc of contact of 90 to 120 degrees at the bottom of the bearing. The same result could be accomplished by boring the bearing to the same radius as the shaft. Failure of bearings operating under boundary lubrication conditions can often be traced directly to inadequate seating or scraping.

In most cases, oil is applied through a hole in the top of the bearing. A groove, parallel to the axis of the shaft, but not extending to the ends, is usually located in the top half of the bearing for the purpose of distributing the oil along the length, as shown at *A* in Fig. 4. No other grooving is necessary or desirable in most bearings arranged for boundary lubrication, although additional grooving, slightly below the center line and of the same size and nature as the top distribution groove, can be provided to act as a small reservoir to supply additional oil during starting. These auxiliary grooves, see view *B*,

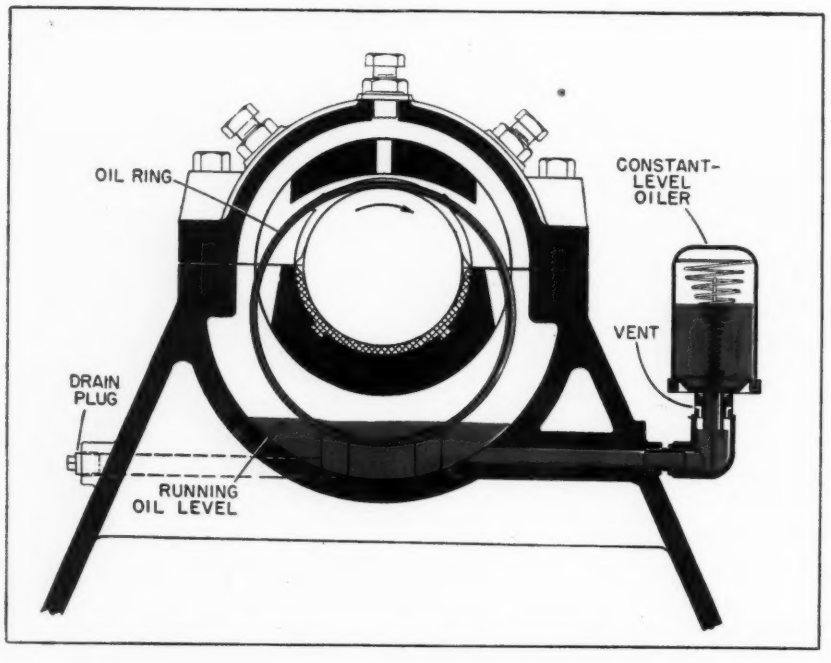


Fig. 2. Constant-level Oiler Applied to Two-part Ring-oiled Motor Bearing. This Device is Often Employed to Maintain Correct Oil Level in Ring-oiled Plain Bearings and Bath-lubricated Anti-friction Bearings. Low Oil Level Permits Air to Enter the Inverted Bottle and Displace the Oil, which Flows to the Bearing Reservoir. This Continues until the Oil Level is High Enough to Cover the Mouth of the Bottle, which Prevents Further Entrance of Air. The Space Surrounding the Spout of the Bottle Must be Vented to the Atmosphere. The Reserve Oil Supply is Constantly Visible

Fig. 4, normally are installed only in large, low-speed units.

Frequently, designers put cross grooves or X-grooves in the bottom of a bearing. This is an objectionable practice, as such cross grooving decreases the area supporting the journal and thus reduces the load-carrying ability; it also provides canals, which carry the oil from the pressure area and permit it to leak out at the ends of the bearing. The result is more rapid loss of the oil from the bearing and inadequate lubrication.

Occasionally a bearing designed normally to operate under downward pressure will be found operating under upward pressure. The most common example of this occurs where belts are installed overhead and the tension of the belt tends to pull the shaft up against the top half of the bearing. This frequently results in bearing failure, since under such circumstances, the distribution groove is in the pressure area, and no seating has been provided. In such a case, the groove should be filled in, the top half of the bearing scraped in, and a new groove cut about 45 degrees from the top of the bearing and out of the pressure area (see view *C*, Fig. 4).

Efforts to minimize the personal element in hand-oiling, provide uniform oil feeds, and make less frequent attention necessary have resulted in the development of many oiling devices. Among these are the familiar bottle oilers, wick-feed cups, drop-feed cups, and mechanical force-feed lubricators. In addition, there are many bearing designs that incorporate an oil reservoir in the housing (Fig. 5) and employ yarn, waste, or special wicks to supply the bearing by capillary action.

Grease Lubrication of Plain Bearings

Plain bearings that are grease lubricated are somewhat similar in construction to oil-lubricated bearings operating under boundary oil-film conditions. Such bearings are not provided with well sealed housings, and leakage and contamination from external sources are factors to be considered.

Grease has greater ability than oil to stay in a bearing, and because of this, there is less leakage, especially in vertical bearings and in bearings where clearances are necessarily large, or where the operating temperatures are high. It also has good sealing ability against such contaminants as dust, grit, and water, and is often used in machines where bearings are subjected to water washing or are exposed to a dusty atmosphere. Finally, grease-lubricated bearings generally require less frequent renewal of the lubricant, and this is advantageous where application is inconvenient or hazardous. Grease is also widely used in the low-speed, heavily loaded bearings of large machinery.

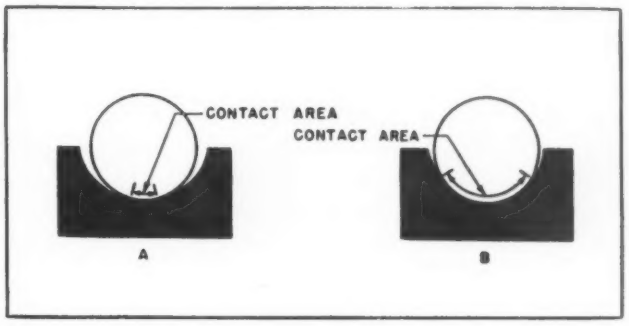
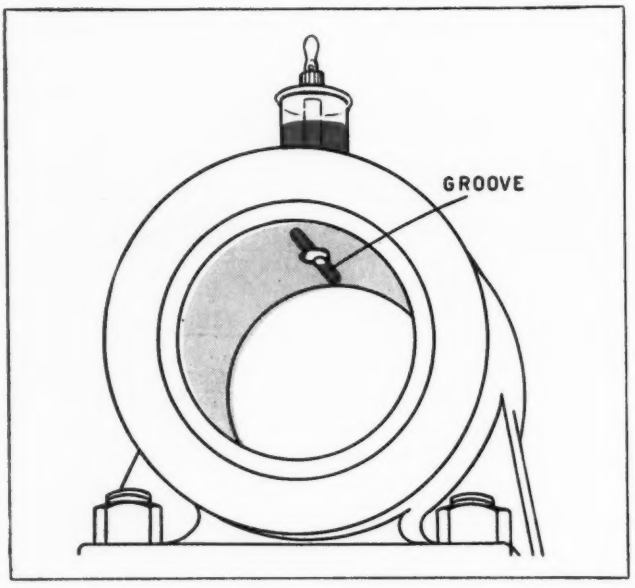


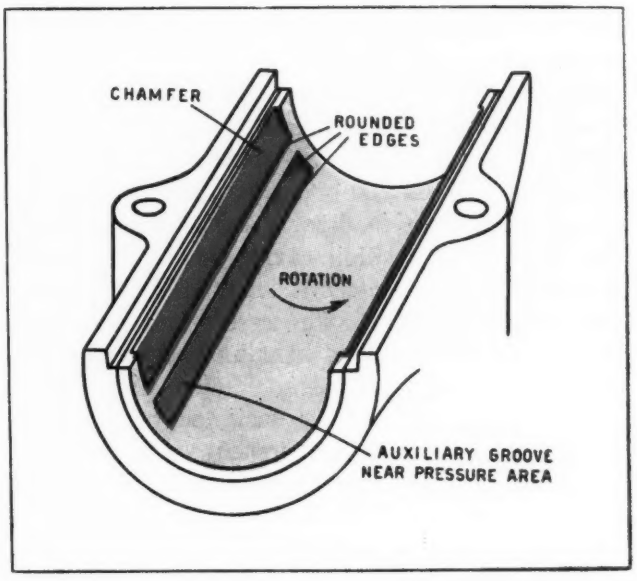
Fig. 3. The Unseated Bearing Shown at A Could Not Carry Heavy Loads without Excessive Wear and Friction. To Prevent Film Rupture and Minimize Such Conditions, the Bearing Load Can be Distributed Over a Large Area by Scraping the Bearing to a Fit over an Arc of 90 to 120 Degrees, as Shown at B

The same principles apply in designing grooving for grease-lubricated plain bearings as for boundary oil film lubrication, except that grease grooves are generally wider and deeper. The extra capacity of the larger grooves provides a more uniform supply of grease to the pressure area between regreasings. Auxiliary grooves are sometimes cut in large bearings part way between the axial distribution groove and the pressure area to provide an additional reservoir. Annular grooves, close to the ends and connected with the axial distribution groove, have been found to reduce leakage. Grease forced to the ends of a bearing in the pressure area goes into these annular grooves and is carried into the portions of the bearing where the clearances are larger.

Means for applying grease in plain bearings include screw-down cups, hand-guns, and hand or automatically operated pressure grease systems, all of which provide intermittent feeds; and spring-loaded cups, as well as open cap housing constructions for hand packing or for the use of block grease, which provide continuous feeds between refillings. As screw-down cups



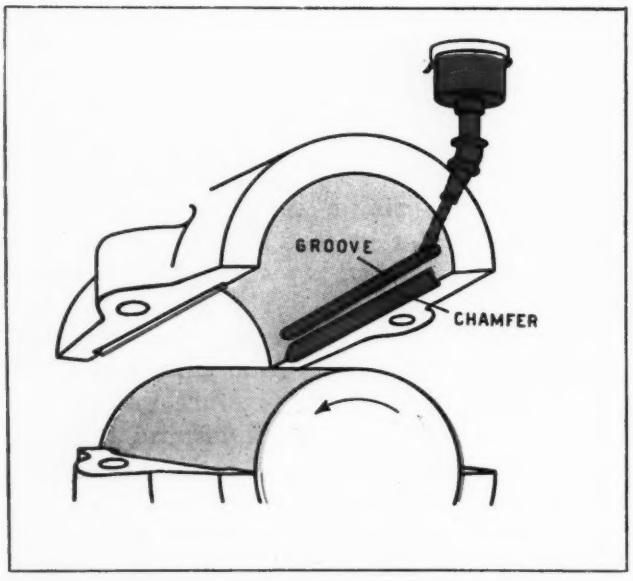
A



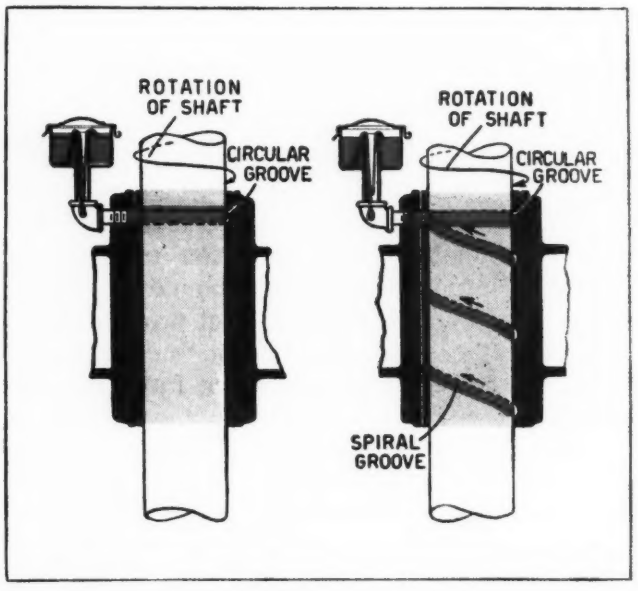
B

Fig. 4. Grooving of Plain Bearings. (View A) A Single Groove in the Upper Part of a One-part Bearing is Usually All that is Necessary to Secure Adequate Distribution of Oil along the Top of the Journal. Bottle Oilers or Wick Cups May be Used as Feeding Mechanisms. (B) In Low-speed, Heavy-duty Bearings, it is Usually Desirable to Cut an Auxiliary Groove in the Lower Half of the Bearing, Just Ahead of the Pressure Area, in Order to Assure a Full Supply of Oil along the Length of the Bearing at that Vital Spot. (C) The Pressure in This Bearing is upward against the Cap. Oil Should be Introduced at the Side of the Cap Just Ahead of the Pressure Area, and its Distribution Should be Assisted by Suitable Grooves and Chamfers. (D) Many Vertical Bearings Require No Grooving, although an Annular Distribution Groove at the Top is Sometimes Desirable. In Certain Cases, where Leakage in Vertical Bearings is Excessive, a Spiral Groove in the Bearing, as Indicated at the Right in This View, Not Only Minimizes the Leakage, but also Assures Effective Distribution of the Oil throughout the Bearing

C



D



are effective only if turned at regular intervals, spring-loaded cups should be used on inaccessible moving parts.

The method of application depends on operating and maintenance conditions, such as accessibility, frequency of greasing required, and number of bearings; class of machinery; and custom. The frequency of greasing is affected by such factors as bearing clearance, loads, temperature, grooving, alignment, and vibration. Where intermittent feeds are used, periods between greasings vary from about two hours to a day or more.

Oil Lubrication of Anti-Friction Bearings

In anti-friction bearings, the motion between the balls or rollers and their races is theoretically pure rolling, as compared to sliding in plain bearings. This rolling motion, however, is altered slightly by minute elastic deformation of the balls or rollers and their races caused by the load. Lubrication cannot, of course, prevent such normal elastic deformation, but it minimizes friction due to slippage, protects the highly polished metal surfaces against wear and rusting, and aids in sealing the bearing housings against the entrance of dust, dirt, and abrasives.

Where the atmosphere surrounding these bearings is relatively clean, and where slight leakage is not harmful, oil is considered the most desirable lubricant. Only small rates of oil feed to bearing surfaces are required. Churning of excess oil results in unnecessarily high operating temperatures because of fluid friction. Many methods have been employed for applying oil to anti-friction bearings. Basically these may be classified as: Circulation, bath, splash, drop-feed, wick-feed, and atomizing or spraying. Two of these methods are illustrated in Fig. 6.

In practice, two or more methods are often used in combination. In bath and splash oiling, the designer must provide accurately located fittings for oil-level control. Too low oil level will result in inadequate lubrication, and too high oil level will cause excessive churning of oil and high operating temperature. In bearings designed for drop- or wick-feed, ample provision for draining away the used oil is essential. Atomizing or spraying is accomplished mechanically, as with slingers, or by the use of dry compressed air.

The choice of an oiling method for a particular case depends on the type of machine, accessibility, frequency and quality of maintenance, and conditions surrounding the bearing. Suitable lubricating oils are available for all methods of application and for wide ranges of speed, load, and operating temperatures. Such oils should have adequate film strength to minimize metal-to-metal contacts, as the oil films between frictional surfaces in anti-friction bearings are very thin.

Oil viscosity must be suitable for the operating temperature and speed, and must be such as to insure rapid distribution and minimum fluid friction. In bath, splash, and circulation systems, the lubricating oil must have high chemical stability to resist the strong oxidizing influence resulting from the continuous churning

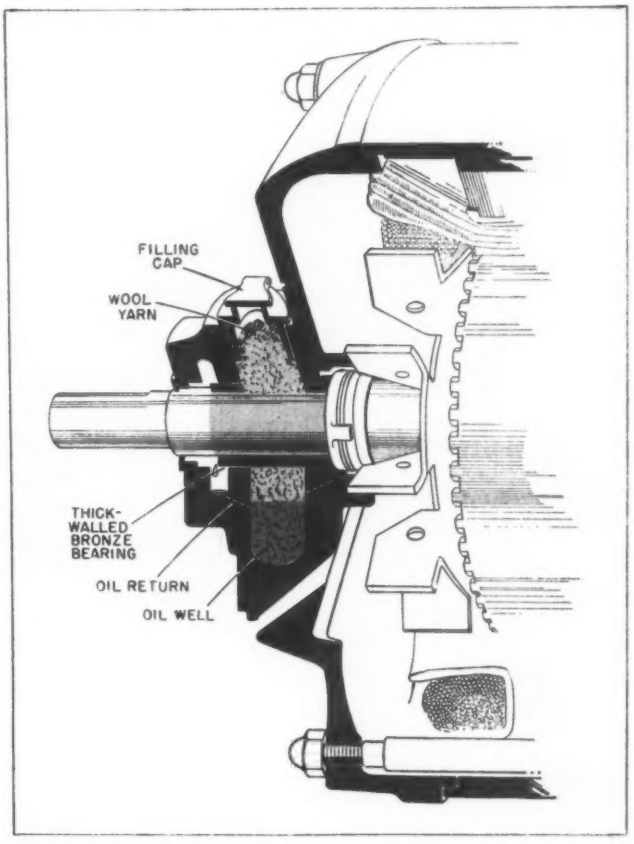


Fig. 5. Yarn-packed Bearing of Split-phase Motor. A Bundle of Long-fiber Wool Yarn is Looped over the Shaft with Both Ends Extending to the Bottom of the Oil-well. The Yarn Draws the Oil up by Capillary Action to the Revolving Journal

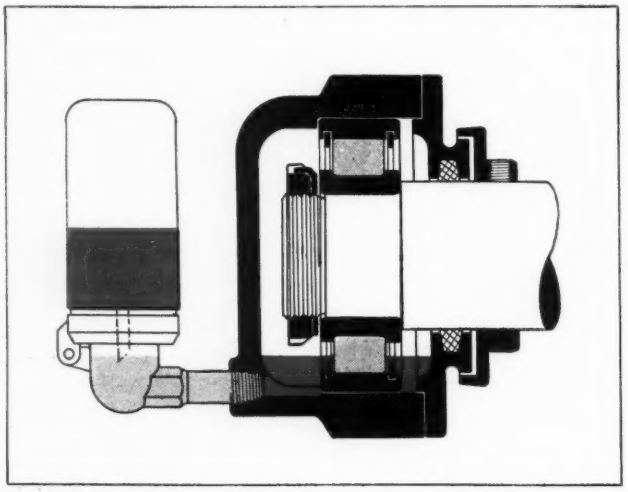
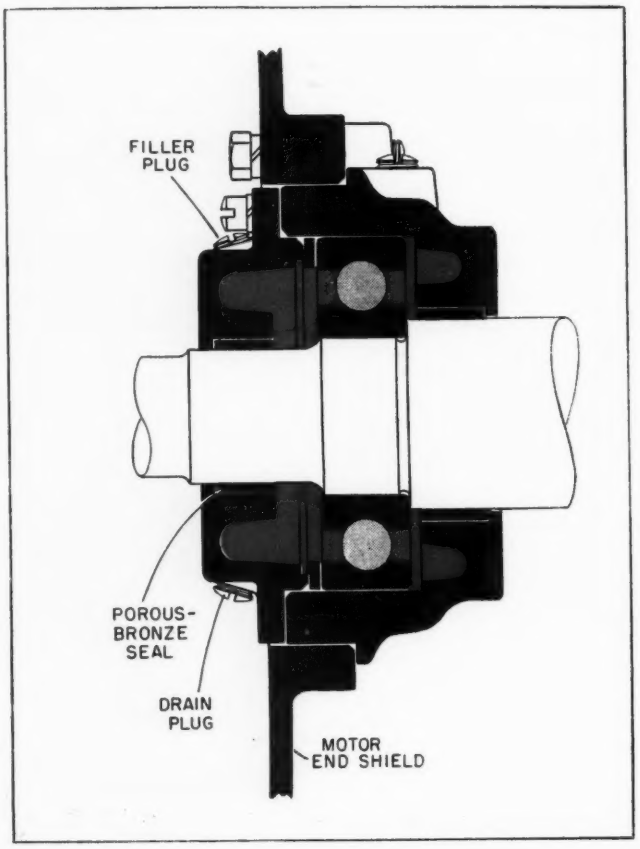


Fig. 6. (Above) A Cylindrical Roller Bearing Lubricated by Oil Splashed from a Bath in the Lower Portion of the Housing. A Constant-level Device Maintains Proper Level of Oil and Assures Adequate Lubrication without Overheating. (Below) Single-row Ball Bearing Arranged for Grease Lubrication. This Cartridge Type Bearing Permits Removal of the Motor End Shield without Disturbing the Bearing Assembly



and splashing of the oil in contact with warm air, as the same oil is used over and over again for long periods.

Grease Lubrication of Anti-Friction Bearings

The greater number of anti-friction bearings are grease lubricated because the grease can be retained in the bearings even when the shafts are not in a horizontal position; this helps to prevent contamination of adjacent parts and minimizes the consumption of the lubricant.

Small quantities of grease only are required for the actual lubrication. The space between the races should not be more than one-third full at the time of filling. The clearance spaces at the ends of a bearing provide a reservoir of grease that aids in excluding dust, dirt, or other impurities from the bearing. Effective shaft seals must, of course, be provided. During operation, grease is thrown by centrifugal force away from moving parts, so that not only should adequate end-clearance space be provided, but the design should be such that the grease is held in close proximity to the bearing.

The wall of grease should be relatively firm, so that only the quantity required for lubrication will flow to the bearing. For high-speed operation, a grease that is stiff enough to channel is used. Grease is fed slowly to the bearing by vibration, and small quantities are flicked off by the rapidly revolving parts.

Excess grease in the path of rotating parts offers high resistance to motion. A considerable part of this grease is kept in motion, and high operating temperatures result. Under these conditions, temperatures high enough to soften bearing surfaces have been known to occur. In any case, excessive temperatures increase the rate of oxidation and shorten the life of the grease charge. The designer, therefore, should consider the method of greasing to be used, and make convenient and effective provisions for lubricating by that method.

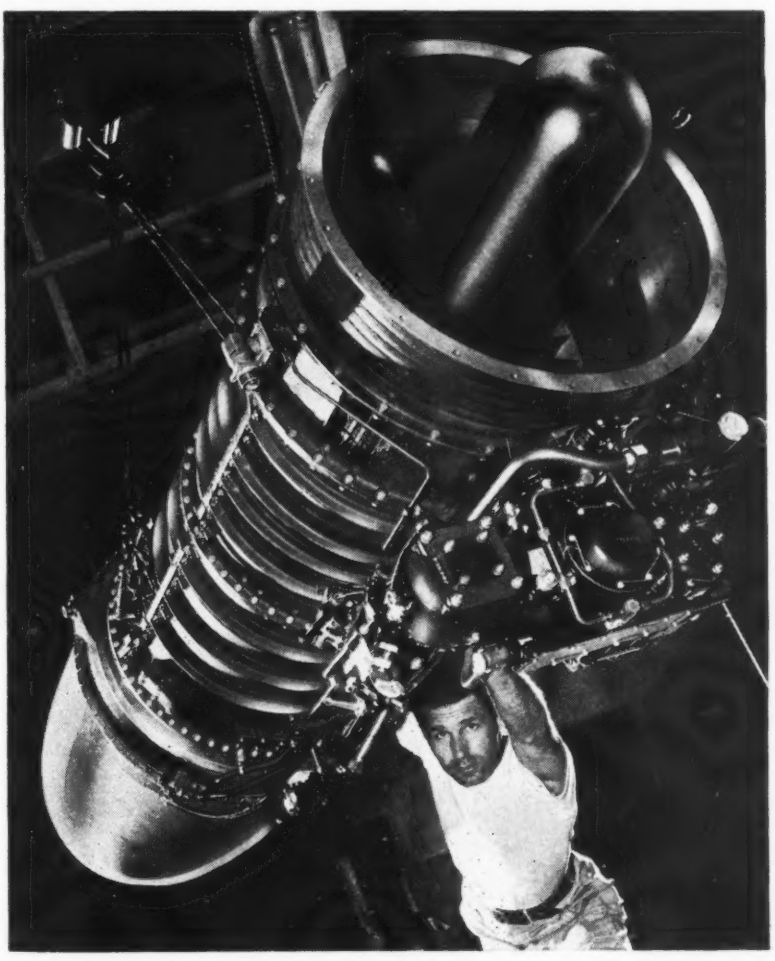
The use of screw-down cups is not generally satisfactory for anti-friction bearing lubrication. There is always danger of over lubrication with these devices. In some cases, bearing housings are designed to be hand-packed with grease, and no openings are provided for greasing. Examples of this are found in bearings operating under conditions that do not severely tax the lubricant and consequently require infrequent

regreasings. This construction may also be found in bearings of machines that are regularly disassembled for other maintenance or inspection work, at which times the bearings can conveniently be cleaned and repacked.

Some bearings are provided with a grease fitting, but no drain opening. Grease may be applied by hand-packing, followed by periodic additions of small amounts of grease through the fitting. Such bearings are liable to overgreasing, unless the amount of grease to be added and the intervals between additions are carefully determined.

A common and generally satisfactory arrangement is to provide a filling and a drain opening. If the drain opening is of ample size and is located at the bottom of the bearing housing, both cleaning and regreasing can be accomplished without disassembly. In this case, cleaning may be done by solvent flushing, and it is important that the drain opening be located so that the solvent will drain out completely. Regreasing may be accomplished by the use of a hand grease gun. The drain is left open during refilling and for some minutes after, until excess grease is forced out of the housing by the rotating parts. The drain opening must be of ample size to relieve grease pressure quickly, thus preventing damage to bearing seals.

Anti-friction bearing housings that are designed for grease application by hand grease guns should incorporate means for guiding the new grease so as to purge the housing of the old grease. This has been accomplished in some cases by the use of baffles in the bearing caps; in other instances, this is provided for by locating the filling and drain openings 180 degrees apart —on opposite sides of the bearings.



Turbojet Engine Built by the Westinghouse Electric Corporation for Fighter Planes Flown at a Top Speed Greater than 600 Miles an Hour. This 24-inch Diameter Simple-cycle Axial-flow Turbojet Engine is Said to have an Unusually Low Frontal Area Drag

Safety Attachment for Power Saws

By REGINALD J. GILSON
Transformer Division
Westinghouse Electric Corporation
Sharon, Pa.

IN operating a power saw, it is often necessary for the operator to place his hands near the revolving blade when cutting material or when removing the pieces. To avoid the danger of accidents, means should be provided for protecting the operator. The safety device shown in Fig. 1 was designed to obviate the need for the operator's placing his hands near the saw in removing work. It is installed on a power saw used for cutting copper. The device consists of a spring plunger and trigger arrangement that flips away the pieces of material as they are cut off by the blade.

The upward stroke of the saw sets the mechanism by means of cable *A*, which is fastened to the moving frame, passes around a pulley, and is connected to a plunger *B*. When the down stroke of the saw is completed, the frame comes in contact with the tripping mechanism, thus releasing the plunger, which pushes the material away from the saw. An adjustment screw *C*, mounted on the trigger arm *D*, permits the release time to be coordinated with the depth of the cut. Fig. 2 shows the saw after the piece has been cut, the mechanism tripped, and the piece pushed away from the blade.

This device not only provides safety for the operator, but also increases production. On large-scale production, where a stop is used to cut all pieces to the same size, the operator is not required to take his hand from the saw feeding arm in order to remove the piece after a cut.

Fig. 1. Spring Plunger B is Set by Up Stroke of Saw, and is Released on Down Stroke when Saw Frame Comes in Contact with Tripping Mechanism

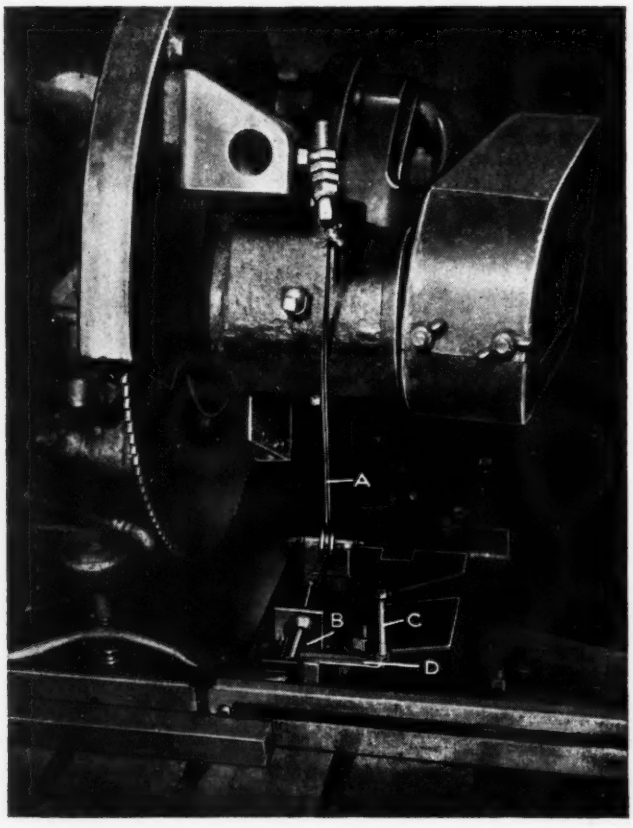
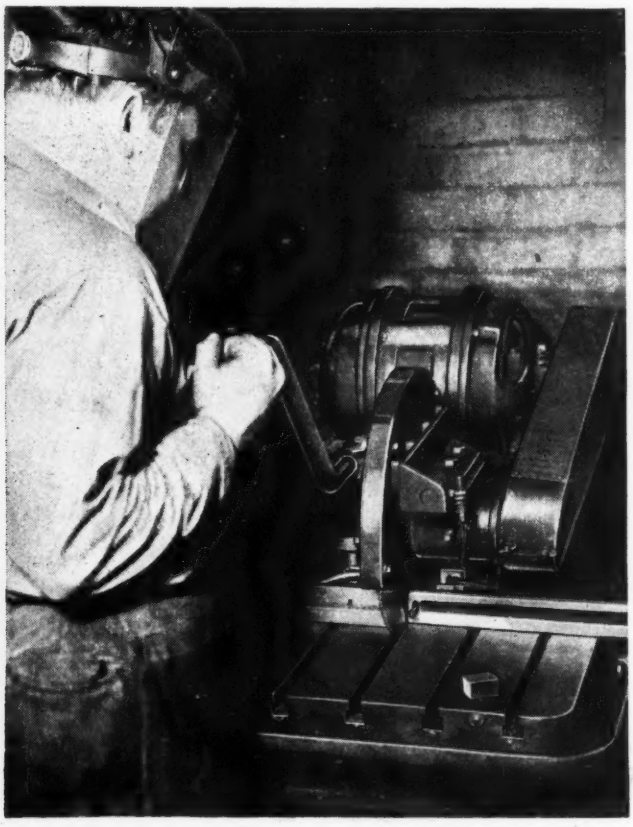


Fig. 2. After the Plunger is Released, it Pushes the Piece that was Cut off Away from the Saw Blade, Thus Protecting the Hands of the Operator



Sound Advice for 1948 from a Page in History

THE year 1948 opens up with its hundred and one problems to beset the individual citizen and every business enterprise. The American standard of living appears to be threatened by the heights to which the prices of everyday commodities have soared and by scarcities due to our own heavy demands and those of Western Europe. Our heavy taxes have become burdensome to the point where substantial relief seems necessary. Pessimistic economists are again prophesying some form of business setback—of course, within an indefinite period.

At such a time it is reassuring to read what the seers and philosophers of years gone by said under similar circumstances —from the pages of history it is apparent that our present situation is not novel. Read what Robert Southey wrote in the "Edinburgh Review" in 1830 — one hundred and eighteen years ago:

"The present moment is one of great distress. But how small will that distress appear when we think over the history of the last forty years—a war, compared with which all other wars sink into insignificance; taxation such as the most heavily taxed people of former times could not have conceived; a debt larger than all the public debts that ever existed in the world added together.

"If we were to prophesy that in the year 1930 a population of fifty million, better fed, clad, and lodged than the English of our time, will cover these islands; that machines constructed on principles yet undiscovered will be in every house; that there will be no highways but railroads; no traveling but by steam; that our debt, vast as it seems to us, will appear to our great grandchildren a trifling encumbrance which might easily be paid off in a year or two, many people would think us insane.

"Hence it is that though, in every age, everybody knows that up to his time progressive improvement has been taking place, nobody seems to reckon on any improvement during the next generation. We cannot absolutely prove that those are in error who tell us that Society has reached the turning point, that we have seen our best days. But so said all who came before us, and with just as much apparent reason. It is not by the intermeddling of the omniscient and omnipotent state, but by the prudence and energy of the people, that England has hitherto been carried forward in civilization; and it is to the same prudence and the same energy that we now look with comfort and good hope.

"Our rulers will best promote the improvement of the people by strictly confining themselves to their own legitimate duties; by leaving capital to find its most lucrative course, commodities their fair price, industry and intelligence their actual reward, and idleness and folly their natural punishment; by maintaining peace; by defending property; by diminishing the price of law; and by observing strict economy in every department of the state."

Here is a call to renewed faith in national progress that is truly as applicable in 1948 as it was over a century ago. Here is sound advice which Congress and the national administration could well follow to the benefit of all.

Charles O. Herb

Induction Heating for Forging Operations

By J. M. BUTLER, Manager, Forge Division
Willys Overland Motors, Inc.
Toledo, Ohio

WHEN induction heating machines were installed in the Willys Overland forging plant a little more than a year ago, the general suitability of this type of equipment for forging work had been established. However, there was still a question as to how well induction heating machines would stand up under continual usage adjacent to a 1500-ton forging press. Also, it was uncertain as to whether the decrease in scale produced on the billet and the increase in die life which this equipment indicated would justify the original investment. After a year of operation, the equipment has proved to be satisfactory in all respects for this work.

The induction heating equipment being used for this purpose consists of three standard motor-generator type Tocco induction heating units, each rated at 150 K.W. and 10,000 cycles. Each machine provides power to one of the three coils seen on top of the special fixture in Fig. 2. This type of induction equipment was selected for several reasons: Its rugged construction was well adapted for the severe conditions of a large forge plant; the 10,000-cycle frequency was more suitable for "through heating" of this particular section than the much higher frequencies obtained from vacuum-tube oscillators; and a similar machine had proved its dependability on another application during war years.

Fig. 1. Billet (Top) and Tractor Track-link Forging (Below)

The operation involves the heating of billets preparatory to forging tractor track links. There are several different link sizes produced on this equipment, but for the purpose of simplicity this description will be confined to the medium-size link. The billet for this link is 3 3/8 inches wide by 1 inch thick by 7 1/2 inches long, and weighs 6.8 pounds. The material from which it is made is S A E 1040 steel.

The billets are placed in three hoppers by a single operator. They are then moved through the inductor coils by pusher feed mechanisms that are actuated by air cylinders. Each cylinder is electrically connected to an automatic timer that is preset to make a stroke every thirty-two seconds. Since the three pusher mechanisms are staggered, one heated billet is ejected on a chute adjacent to the press every 10 2/3 seconds.

The inductor coils are 31 inches long, and each consists of thirteen turns of 1/2-inch square cop-

Fig. 2. Three-line Tocco Induction Heating Fixture for Heating Billets in Preparation for Forging

per tubing. They are known as "two stage" coils because the spacings between the turns are small at the entrance end of the coil and wide at the ejection end. Thus, the first stage provides an intense magnetic field, which brings the billets rapidly up to temperature, and the second stage, with wider spacing and a less intense field, serves primarily to hold the temperature at about 2325 degrees F. The coils are water-cooled to prevent overheating. Production is 336 heated billets (or 2300 pounds, per hour), which equals a heating rate of 5.1 pounds per kilowatt hour.

This compact installation provides several advantages for a forging plant. The elimination of radiant heat and gases provides favorable working conditions, and the water-cooled design of the generating equipment, with sealed cabinets, prevents infiltration of dirt and dust. The principal advantages, however, are the uniformity of heating and the almost complete lack of scale, which has increased the die life nearly 300 per cent. The average die life is now 18,500 pieces per finishing die, and 35,000 parts per blocking die. In testing induction heated billets with thermo-couples, it has been found that there was only a 20-degree F. differential between the surface and the center temperatures. By the time the billet has reached the forging press, even this small temperature differential has become less. The scale produced is less than 0.001 inch, compared with 0.050 to 0.100 inch when conventional heating methods are used.

* * *

According to statistics compiled by the U. S. Department of Labor, the cost of industrial accidents during 1946 was two billion dollars.

Special Anti-Friction Bearings for Gas-Turbine Planes

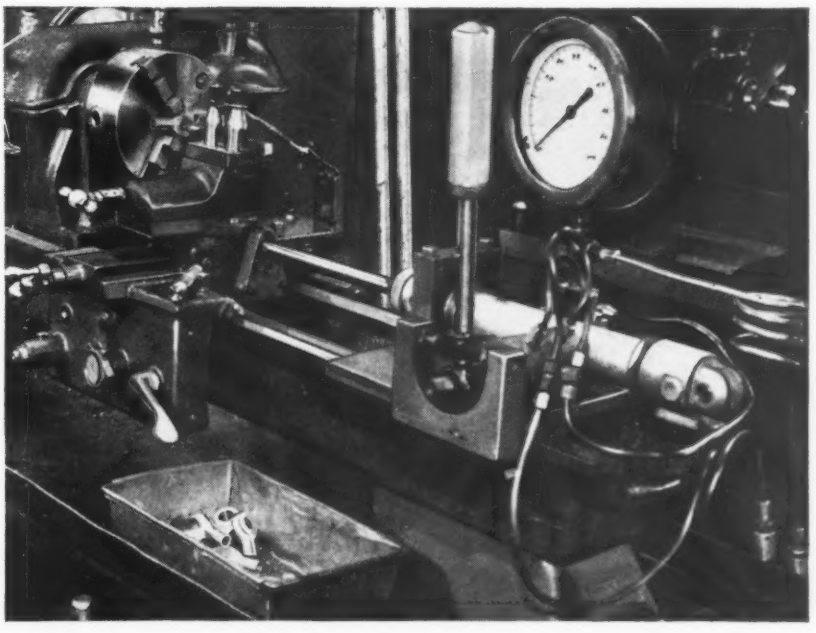
Special ball and roller bearings designed to operate under the high speeds and temperatures of gas-turbine aircraft engines have been developed by S K F Industries, Inc., Philadelphia, Pa. The major difference between these units and conventional bearings is that the bearing retainers are centered on the rings instead of the rolling elements, internal clearances are adjusted to compensate for expansion, and all rings are stabilized by a heat-treatment to lessen their distortion under operating conditions.

* * *

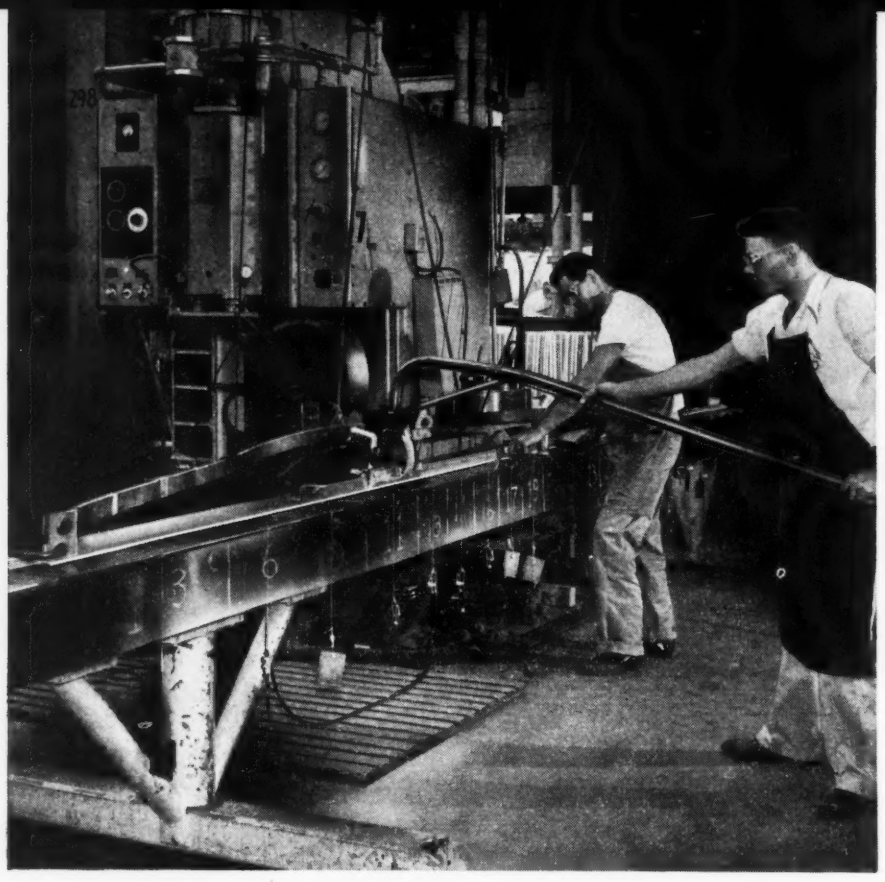
Method of Eliminating Play on a Worn Lathe

Spring or play between the ways, carriage, cross-slide, compound rest, and toolpost of a worn lathe can be taken up to permit more accurate boring by providing the lathe with a turnbuckle mounted between the toolpost and a bracket on the cross-slide. The set-up, as shown in the accompanying illustration, was employed by the Farmingdale Aircraftsmen Mfg. Corporation, Farmingdale, N. Y. With this arrangement, the inside diameter of aircraft parts was bored to within a total tolerance of 0.0003 inch.

Such a close tolerance was made possible by also using a centrally located, hydraulic feeding attachment consisting of a hydraulic cylinder mounted between the lathe ways. The plunger of this cylinder is connected to a centrally located bracket on the cross-slide, and exerts the feeding pressure directly in line with the boring tool.



A Centrally Located Hydraulic Feeding Cylinder and a Turnbuckle Mounted between the Toolpost and the Cross-slide Permit Accurate Boring on a Worn Lathe



Bending and Elevated

The Resistance Heating Process, which Involves Subjecting a Structural Member or Sheet to High-Amperage, Low-Voltage Electrical Current, is being Used in Bending and Forming Aluminum Alloys, and has Increased Their Formability in Many Instances More than 150 Per Cent

TO obtain lighter weight structural members with no decrease in strength, the aviation industry is using 75S-T aluminum in increasing quantities. While this material can be substituted for the heretofore generally used 24S-T alloy in those applications where maximum strengths are needed, it is much more difficult to form in the "T" (fully heat-treated) condition, particularly at room temperatures.

However, recent experiments indicate that the formability of aluminum alloys is considerably increased at elevated temperatures. The alloy 75S-T is particularly suited to forming at elevated temperatures due to the fact that there is no detrimental effect on its strength or corrosion resistance, provided the temperatures do not exceed 300 degrees F. and the heating period is not over one-half hour. It has been found that formability equivalent to that of 24S-T can be achieved at these higher temperatures; and heat-treating, multiple forming, and hand straightening operations can be eliminated as a result of the decreased stresses set up in a section.

Of the various methods employed for heating extruded shapes or sheets, the resistance heating process is the newest and perhaps the cheapest and easiest to apply. It is particularly adapted to parts that must be bent in one or several localized areas. Although the actual time for heating a part is dependent on the cross-sectional area, coupled with the magnitude of current flow, typical extrusions can be brought to a temperature of 300 degrees F. in from five seconds to five minutes.

Any transformer capable of a high, continuous current output can be used as a source of power. For extrusions up to 2 1/4 square inches cross-sectional area and 30 inches long, the 75-KVA transformer of a standard production gun welder (Fig. 1) has been successfully applied. The transformer secondary tap is arranged in parallel to give a continuous current output of approximately 3600 amperes. Water-cooled single conductor leads, 400,000 circular mils in size, are connected to the transformer, and the free ends are clamped to each end of the extrusion to be heated.

Of course, the heating time can be decreased by using a transformer with a larger current output and conductor leads with greater electrical capacity, since a small increase in current materially increases the rate of temperature rise. This is due to the fact that the heat generated is proportional to the square of the current.

For large shapes, bigger transformers are required. The cross-sectional area of a part is the determining factor in estimating the time required for the part to reach forming temperature. Fig. 2 shows extruded shapes of various cross-sections and the time required to heat them to 300 degrees F.; the values given represent the average obtained on sections 12 inches in length using the 75-KVA welding transformer previously described. Naturally, the length of the extrusion also affects the heating time, since increased length means greater impedance in the circuit, and hence a decrease in current flow.

Heat uniformity can be maintained within

Forming of 75S-T Aluminum at Temperatures

By M. L. OCHIEANO
Production Methods Engineer
Lockheed Aircraft Corporation, Burbank, Calif.

about ± 10 degrees F. around a given cross-section, and within ± 10 degrees F. along the length of a part. Thus, the average over-all temperature differential will be approximately ± 20 degrees F.

In clamping an extrusion, it is recommended that the electrodes be fastened at diagonal corners. All cases indicate that the time required to heat an extrusion when the current travels diagonally across the part is equal to or less than that required when the electrodes are in line and the current flows straight through.

A hand pyrometer can be used to indicate temperatures during initial production; should the structural shape be large and costly, the pyrometer can be used for all production work. However, after the heating time has been determined on several specimens, the time values alone will give fairly reliable results; or "Tempilstiks," which melt at prescribed temperatures, can be used.

It is important that the temperature to which a part should be heated for bending be within 250 to 300 degrees F., as it is within this range that best results are obtained. Below 250 degrees F. the ratio of strain to the angle of bend increases; above 300 degrees, prolonged heating may change the physical properties of the material.

Bending Wing Beams and Beam Caps

The advantage of resistance heating can be seen in its application to bending an upstanding leg on the wing beam for a medium bomber. This leg was to be bent a total of 6 degrees from one end to the other. The rejection rate on the cold-formed extrusion was excessive, and in addition, it was felt that incipient cracks not readily detected by normal inspection methods might exist in the finished parts.

The use of the hot-forming process more than doubled the formability of 75S-T and eliminated the danger of incipient cracks. The beam was clamped along one flange on a table, as shown in the heading illustration, and copper leads run from a 400-KVA welding transformer to each end. A thermostat was attached to the beam and regulated to give a temperature of slightly under 300 degrees F. The transformer delivered a current of 5000 amperes at four cycles "on" and two cycles "off" for ten seconds, and was off for ten seconds. The time actually required to hot-form the part was ten minutes. The total time, which included locating, clamping, forming, inspecting, and removing the part was twenty minutes. The time required to bring the beam to forming temperature was one minute forty-five seconds.

As will be noted in the illustration, the beam is bent manually after it reaches the prescribed temperature, since the limited quantity required made the tooling of a power brake for the operation too expensive. The total cost of the resistance heating arrangement (not including the welder and table, both of which were available) was less than $50.

Another successful, though less spectacular application of resistance heating was in the bending of T-shaped beam caps. The beams, 30 inches in length, were bent through an angle of

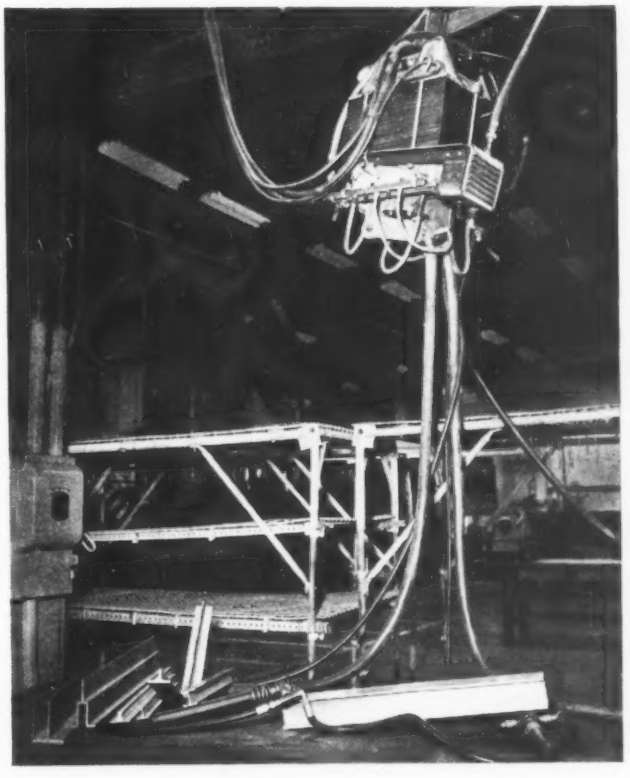


Fig. 1. The 75-KVA Power Transformer of a Standard Production Gun Welder has been Used for Resistance Heating of Extrusions up to 30 Inches Long and 2 1/4 Square Inches Cross-sectional Area

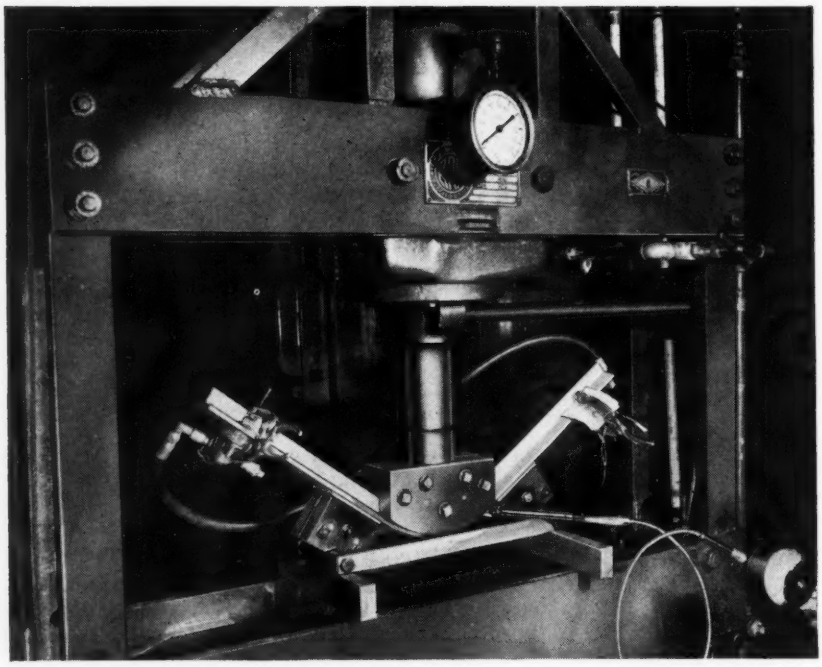


Fig. 3. An Arbor Press being Used to Bend a Beam Cap to an Angle of 62 Degrees. The Work was Heated to a Temperature of 295 Degrees F. Preparatory to the Bending Operation by Resistance Heating

C2 degrees on a hydraulic arbor press, as shown in Fig. 3, while the heat was generated by current from a 75-KVA power transformer. High-amperage, low-voltage power was used, the peak magnitude of the current being 8500 amperes and the voltage 9. Current flowed through four cycles (1/15 second) and was off for twenty-four cycles (2/5 second). The time for the part to arrive at the forming temperature averaged 3 1/2 minutes, and the forming time was approximately one minute. This time could have been considerably shortened if a continuous-duty power transformer delivering the same amperage, or even a lower continuous amperage, had been used.

It will be obvious from the foregoing that hot

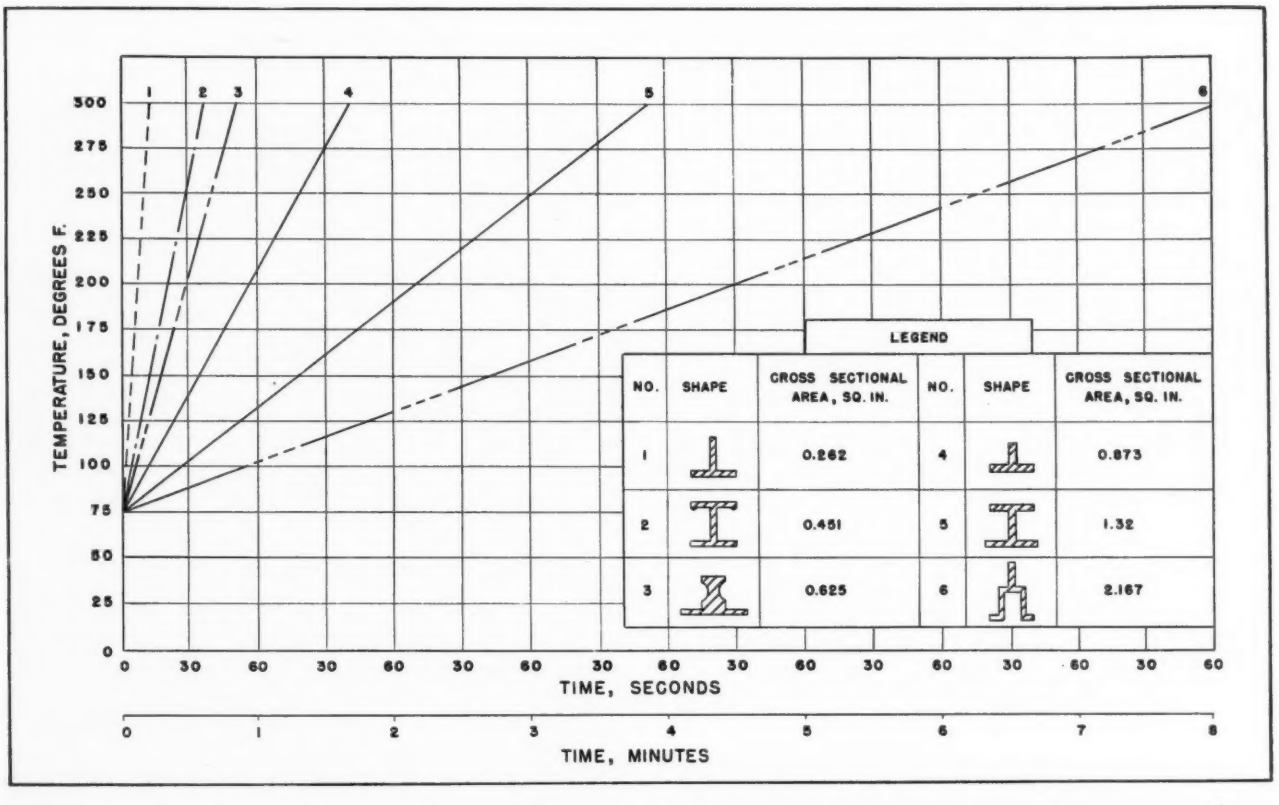


Fig. 2. Time Curves for Resistance Heating of Extruded 75S-T Aluminum Shapes. This Data was Obtained with a Power Input of 43 KVA and a Secondary Current of 3600 Amperes

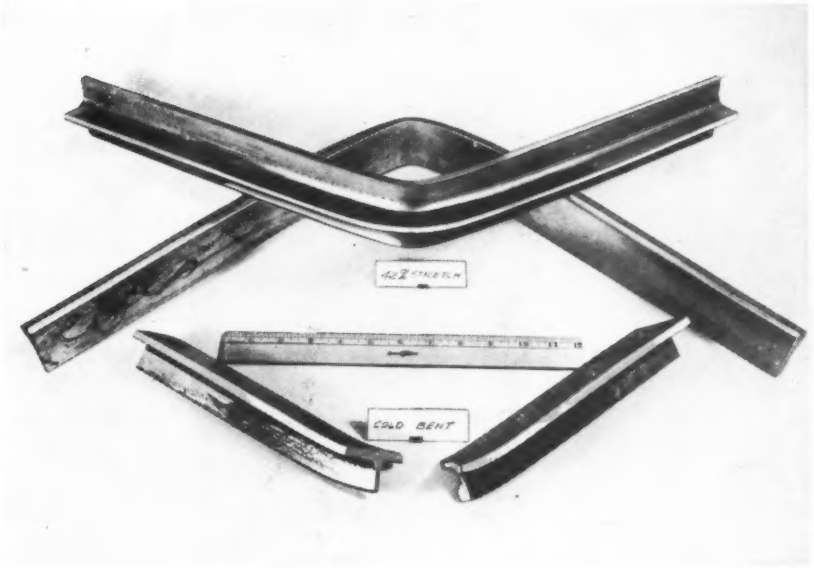


Fig. 4. Graphical Illustration of the Difference between Hot and Cold Bending of 75S-T Aluminum. The Formability of the Section at Elevated Temperatures Averaged 166 Per Cent Greater than when Cold

forming or bending can be accomplished by the use of almost any power transformer, especially those available in resistance welders. No claim is made that these are the most efficient sources of power, but they are available in many shops and give satisfactory results for limited-quantity production. While, in general, a continuous power output is the fastest heating method, intermittent cycles may be better on some parts. These factors can best be evaluated by trial.

Other Methods of Heating for Forming

Resistance heating is not the only method of heating for forming that is employed at the Lockheed plant. Structural shapes are often preheated in a furnace, heated by gas ring burners, or heated by conduction from strip heaters in the tool.

Some examples of typical operations performed successfully at elevated temperatures are given in the following:

1. Bending with heated power-brake tooling will reduce the size of the bend radii required, as shown in the accompanying table. For such an operation, the punch is heated by an electric resistance strip heater, and the blank to be formed is brought to temperature by contact with the punch. Standard tooling is used for operations of this kind.

2. Rubber press hot-forming is accomplished by heating the lower press platen with electric cartridge heaters; the platen, in turn, heats the form block and part by conduction. A heat-resistant rubber blanket may be used to protect the rubber pad, and, in addition, "throw pads" may be used for further protection.

3. Joggling of preformed shapes and extrusions can be done with power-brake tooling heated as described in Example 1.

4. Hot-dimpling can be accomplished on a pneumatic squeezer with dies heated by electric-element heaters; or resistance heating can be employed, with the punch and die acting as electrodes. Dies using electric-element heaters are kept at a temperature of 500 degrees F., and the sheet is dimpled at a temperature between 350 and 500 degrees F.; because the heating cycle is so brief (0.3 to 0.5 second), there is no detrimental effect on the material. Resistance heaters must be calibrated for each gage of sheet to determine the best settings, and here, again, the time cycle is so short that there is no harmful effect on the material.

Minimum Bending Radii (in Inches) for 75S-T Aluminum Sheets of Various Thicknesses

Material	Sheet Thickness, Inches													
	0.016	0.020	0.025	0.032	0.040	0.051	0.064	0.072	0.081	0.091	0.120	0.125	0.156	0.187
75S-T Cold	0.12	0.12	0.12	0.16	0.22	0.25	0.31	0.38	0.44	0.50	0.62	0.75	1.00	1.25
75S-T Hot	0.09	0.09	0.09	0.09	0.12	0.16	0.22	0.25	0.31	0.38	0.44	0.62	0.88	1.12

Selecting the Right Size of Grinding Wheel

The Size of Grinding Wheel Used for a Particular Job Has an Important Influence on Surface Quality of Work, Grinding Costs, and Rate of Production

By JOHN F. FISCHER
Manager Sales Engineering
Simonds Abrasive Co.
Philadelphia, Pa.

QUALITY, production rate, and cost of grinding depend to a large degree upon the type of abrasive, grit size, type of bond and its hardness, and structure or grain spacing of the grinding wheel used. It is usual for progressive machine shops to pay careful attention to selecting wheels of correct specifications as regards the foregoing factors for each grinding job. Comparatively little attention, however, is given to choosing wheels of the most suitable diameter and width, although the wheel size has a marked effect upon grinding costs, surface quality of work, and rate of production.

It is not uncommon to find a shop using wheels that are too small on the theory that since their selling price is less than that of large wheels, the wheel cost will be less. Just the opposite is true. The only thing that affects the wheel cost is the cost per cubic inch of usable abrasive, which is determined by the price per cubic inch of usable abrasive and the rate of wheel wear—both of which are higher for small wheels than for large ones.

One shop that did considerable off-hand grinding was equipped with floor-stand machines capable of accommodating 24-inch diameter wheels, 3 inches thick, but was actually using 8-inch diameter wheels. The reason was that the foreman was unduly impressed by the fact that the large wheels cost about thirty-seven times as much as the small ones. Actually, the price being paid per cubic inch of usable abrasive was more than twice as much for the small wheels as it would have been for the large ones. This was, of course, an extreme case.

The number of cubic inches of usable abrasive in a wheel increases with the diameter so much more rapidly than the price of the wheel that what may seem like a slight difference in diameter between wheels may make a great difference in cost per cubic inch. Consider the following table covering six wheels commonly used in cylindrical grinding:

Wheel Size, Inches	Approximate Cost per Cubic Inch of Usable Abrasive, Cents
24 by 2 by 12	5.7
24 by 3 by 12	5.5
24 by 4 by 12	5.4
30 by 2 by 12	4.7
30 by 3 by 12	4.5
30 by 4 by 12	4.4

It is to be noted that the cost per cubic inch of usable abrasive is about 1 cent less for a 30-inch diameter wheel than for a 24-inch wheel of the same width and thickness. This is because there is about twice as much usable abrasive in the larger wheel, while the price per wheel is only about 65 per cent more. While the saving in price per cubic inch of usable abrasive is much less for wider wheels of the same diameter, the total saving is a worthwhile amount.

Even if both large and small wheels wore at the same rate, considering the amount of material removed by grinding, the economic advantage would still be heavily in favor of the larger wheels. For example, a 24- by 2- by 12-inch wheel contains only about one-fourth as much

usable abrasive as a 36- by 4- by 12-inch wheel. It will therefore last only about one-fourth as long as the larger wheel. In other words, four wheel set-ups will be needed in a given time with the smaller wheel for every one required with the larger wheel. The time per set-up will vary for different jobs, but each wheel must be dismounted, and the new one equipped with flanges, balanced, put on the machine, and trued. Also, if the job is a high-precision one, requiring fine finish, the wheel may have to be removed from the machine, rebalanced, and remounted after truing. Anything that will reduce the number of wheel set-ups is obviously worth while.

The rate of wheel wear depends to some extent upon the diameter of the grinding wheel. A small wheel acts softer and wears faster than a large one. Substituting a small wheel for a large one may make it necessary to change the specification of the wheel to one of harder grain, finer grit, or closer structure to produce the surface quality desired and prevent excessive wheel wear. This is because one factor influencing grinding action is the area of contact between wheel and work. If the area of contact is small, the total pressure between the wheel and the work must be carried by fewer abrasive grains. Each grain, therefore, carries a greater load. The resulting stress on each grain may be enough to fracture it before it becomes dull or tear it out of the bond before its useful life has ended.

The area of contact is the product of the length of the arc of contact and the wheel width. The arc of contact increases with the diameter of the wheel for any given work-piece. Therefore, a wide wheel of large diameter will have a much greater area of contact than a narrow, small-diameter wheel, and will wear more slowly.

Advantages of Wide Wheels

Since the cost per cubic inch of usable abrasive decreases as the width of the wheel increases, it is, of course, most economical to use the widest wheels possible. Wide wheels also have other advantages. In cylindrical and surface grinding with the periphery of a straight wheel, the rate of material removal depends, among other things, on the speed of traverse. Traverse speed, in turn, is limited by the work speed and the wheel width. The wheel must traverse somewhat less than its width in one work revolution; otherwise, the cuts would not overlap, and the wheel would grind a helical pattern on the work. For very fine quality surfaces, it is not sufficient that the edges of the traverse marks merely overlap a minimum amount. For such cuts, it is customary to have the traverse overlap at least one-quarter of the width of the wheel, and, in extreme cases, it may be desirable for the overlapping to be three-quarters of the wheel width. Therefore, the wider the wheel, the faster the traverse and the production can be. From the viewpoint of material removal, it is evident that more abrasive grains are constantly at work when a wide wheel is used. Material removal can therefore be speeded by a wider wheel without recourse to deeper in-feed. Increasing the in-feed would result in greater compression stress and make the wheel act so soft as to increase the rate of wheel wear unduly.

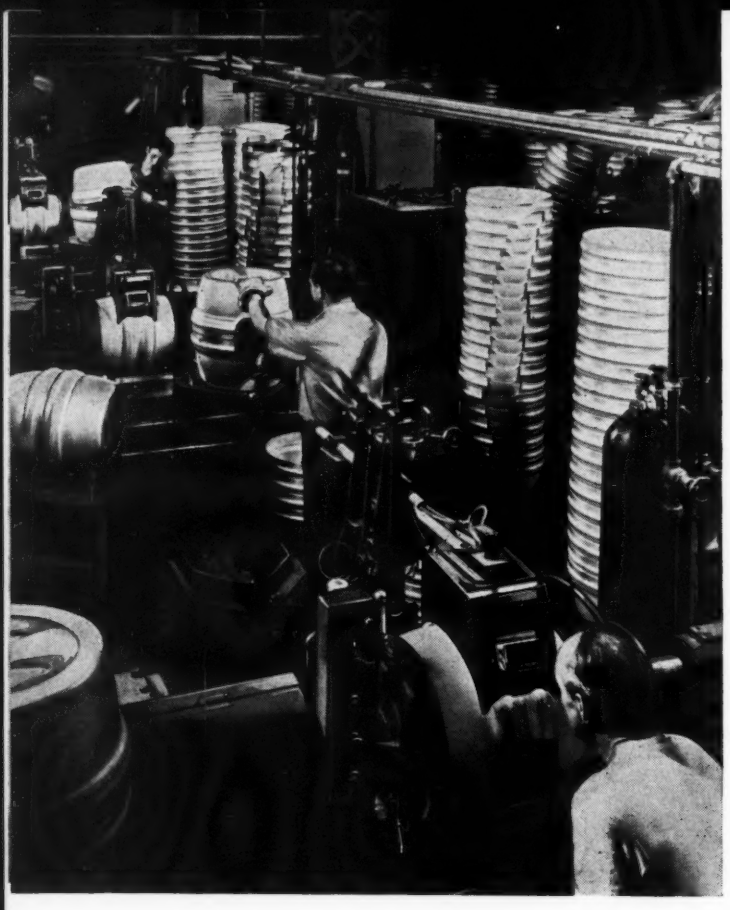
Increases in production rates can often be achieved by substituting plunge-cut for traverse grinding. For plunge-cut grinding, it is necessary to use a wheel somewhat wider than the surface to be ground. Plunge cuts of 15 inches and wider are common. The saving in time over traversing a narrow wheel is evident.

Limitations on Wheel Size

There are certain limitations to the size of wheels that can be used. On cylindrical, centerless, and plain surface grinding machines, there is usually considerable leeway as to wheel thickness, but the machine and its attachments may limit both thickness and diameter. Some machines have insufficient power to drive very wide wheels, owing to the high pressure needed to get adequate penetration of the abrasive grains. The shape of the work may also limit both width and diameter of the wheel. Thus, if a part is slender, the higher total pressure needed in wide-wheel grinding may bend the part.

In internal grinding, the bore of the work limits the diameter of the wheel. With small holes, it is usually desirable to use as large a wheel as possible, in order to get the rigidity of larger wheel-spindles and a greater area of contact to lessen the rate of wheel wear. For example, a 1/2-inch diameter hole would usually be ground with a 7/16-inch diameter wheel.

It should be noted, however, that in internal grinding, the area of contact increases rapidly as the wheel diameter approaches the inside diameter of the hole. If the wheel is too large, the area of contact may be so great as to make the wheel act too hard. For that reason, in grinding larger sizes of holes, there should be a greater difference between the size of the bore and the wheel diameter. It is usually the best practice to limit the diameter of the wheel for grinding a 2-inch diameter hole to 1 3/4 inches. A 4 1/2-inch wheel is about the limit for a 6-inch diameter hole, and a 10- or 12-inch diameter wheel for a 24-inch hole.



Mechanized Welding of Cylindrical and Spherical Shells

Abstract of a Paper on Mechanized Inert-Gas-Shielded Arc Welding, Presented by H. T. Herbst, Development Engineer of The Linde Air Products Co., before the Recent Annual Meeting of the American Welding Society

IN welding together the two halves of sheet-metal cylinders or spheres, the edges to be joined must be truly circular, instead of slightly oval, and they must be firmly pressed against each other. Beer barrels of the type seen in Fig. 1 being produced on machines employing inert-gas-shielded arc welding constitute a particularly good example of this kind of work. In this case, the welding is being performed with Linde equipment.

As these beer barrels have a large opening in the side into which a bung plate is later fitted, an internal mandrel of collapsible construction can be employed to facilitate welding. The mandrel is removed through the bung plate opening at the end of the operation. This mandrel consists of two rigid half rings, hinged together, which can be expanded against the inside of the barrel through a toggle action, as shown in Fig. 2. When the mandrels are expanded, they, in turn, expand the edges of the barrel slightly. This insures alignment of the edges on the two halves and eliminates any distortion from a true circular shape produced in the drawing operation.

Fig. 1. (Above) Production Line of Welding Machines Designed for the Circumferential Welding of Beer Barrels while the Edges being Joined are Supported Internally

Fig. 2. (Left) Construction of a Hinged Mandrel which Insures Satisfactory Welding of Beer Barrel Halves by Providing a Means of Accurately Aligning the Edges of the Barrel Halves

Fig. 3. Welding Operation on Two Halves of a Spherical Shell which Employs Cup-shaped Structural Jigs for Insuring Alignment of the Shell Edges and End Pressure for Forcing the Mating Edges Together

Obviously, a mandrel of the type just described cannot be used in tanks or other shells that do not have an opening through which the mandrel can be removed upon the completion of the welding operation. With such work, two other mounting methods are possible. For example, when the shape of the work permits, as in the case of a sphere, rigid circular cup-shaped jigs, of the construction illustrated in Fig. 3, may be provided to fit the work closely in the welding area. These jigs force the mating edges of the work firmly together and correct any distortion of the circular shape.

Another method of aligning the edges of closed cylindrical or spherical shells consists of using rollers or wheels that are rigidly mounted in such a way as to bear on the work parts as close to the welding zone as possible. One roller should be provided on each side of the seam, just ahead of the welding torch. The position of the rolls should be such as to depress the work edges slightly as the barrel members revolve beneath the rolls.

Circumferential seams in work having a true circular section can be readily welded by revolving the part under the welding torch. In the fabrication of articles not of a true circular section as, for instance, an ellipsoid, it is necessary to vary the speed of work rotation inversely with respect to the radius of rotation in order to maintain a constant welding rate. Also, some means must be provided for raising and lowering the welding torch so as to maintain an arc of constant length.

National Electronics Conference

The annual meeting of the National Electronics Conference, Inc., was held on November 3 to 5 at the Edgewater Beach Hotel, Chicago, Ill. The purpose of the Conference is to present technical papers on electronic research, development, and application. At the recent meeting there were twenty technical sessions during which seventy-eight papers were presented. An unusual amount of interest was shown in the session on "Operation of Electronic Research." One feature of the meeting was an exhibition, which comprised products of forty-five manufacturers representing many phases of electronics. The keen interest in the subject of electronics was evidenced by the large registration—2475.

The National Electronics Conference, Inc., is sponsored jointly by the Illinois Institute of Technology, Northwestern University, the University of Illinois, the American Institute of Electrical Engineers, and the Institute of Radio Engineers, with the cooperation of the Chicago Technical Societies Council.

* * *

One of the closest camshaft checks in the automotive industry is said to be carried out in the inspection department of the Pontiac Motor Division. A special gage is employed that is capable of checking the contour of the cams within twenty-five millionths of an inch.

Engineering News

Stainless-Steel Bumpers to Appear on 1948 Car Models

Automobile bumpers made from Jessop stainless-clad steel will soon appear on the 1948 models of cars and trucks manufactured by two of the largest automobile companies, according to an announcement by the Jessop Steel Co., Washington, Pa. Jessop stainless-clad steel is made by a patented process, and consists of a layer of stainless steel, permanently bonded to a mild-steel backing. The stainless surface will take a lustrous finish, which resists pitting, rusting, and flaking over a long period of time. The mild-steel backing provides mechanical strength and permits easy fabrication.

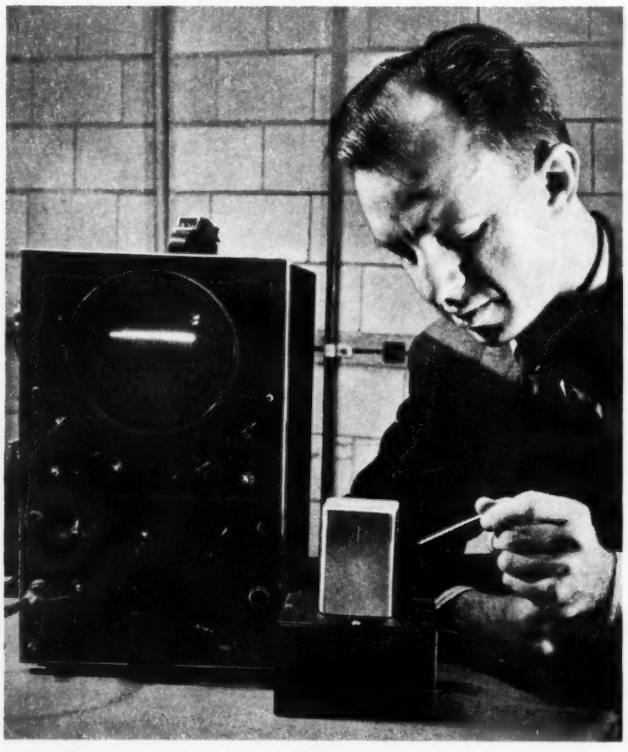
Motors for Research Built for High Speeds and High Frequencies

Three groups of special electric motors are being built by the General Electric Co. for research purposes. The units in one group, having a rating of 0.1 H.P. at 80,000 R.P.M., will be only 1 3/4 inches in diameter by 6 inches long. The squirrel cage, which is the outside, will form the rotor, while the shaft, held stationary, will form the motor support and carry the windings. Among the special motors are two 700-H.P. and two 300-H.P. motors that will operate at 18,000 R.P.M. The motors in each of these groups are four-pole, 600-cycle units, and will be provided with hollow-stator conductors in which water will be circulated to remove the heat. Water will also be used to cool the shells and remove the heat caused by losses in the stator iron.

Because of their high rotating speed, the 700-H.P. motors will be only 14 inches in diameter by 24 inches long. The 300-H.P. motors will be 10 inches in diameter by 22 inches long.

Measuring the Micro-Hardness of Steel

The hardness of individual microscopic grains within a piece of steel can be measured by a new device designed at the research laboratory of United States Steel Corporation of Delaware. Like the Brinell, Rockwell, Vickers, and other traditional hardness testers, but on a much finer scale, the micro-hardness tester operates by indenting the polished surface of a steel sample. Its diamond-point penetrator, under a load of a very few grams, leaves a square mark, which can



Radiations from Exploding Atoms are Counted at the Rate of 100,000 a Second by a New "Atomic Ray Detector" Developed by the Westinghouse Research Laboratories. A Small Piece of Wire Tipped with Radio-active Material is Held a Few Inches away from the Detector, which is Enclosed in the Small Light-tight Box in the Foreground. Particles from the Exploding Atoms Penetrate the Box and Enter the Detector, where They Strike a Fluorescent Screen, Producing Light which is Converted into Electricity and Amplified One Million Times by a Photo-multiplier Tube. This Signal is Then Transmitted to the Oscilloscope, where the Exploding Atoms Appear as Flashing Peaks of Light. The New Detector is Still in the Experimental Stage

A Tiny Diamond is Used to Test the Hardness of Microscopic Grains of Steel in the Research Laboratory of the United States Steel Corporation of Delaware. The Pyramidal Gem has a Square Base and is Minutely Cut to a 136-degree Angle. Its Wedge Point is Capable of Making Three Indentations within the Breadth of a Human Hair

rarely be seen by the naked eye. The diagonals of this tiny square indentation are measured in microns, or thousandths of a millimeter, and this reading is related to the load placed on the penetrator, so that the hardness can be computed.

Preparation of the sample of steel whose hardness is to be measured requires elaborate care. A small sample, which may be mounted in plastic, is ground and finished with polishing paper, care being exercised to prevent the grinding effect from extending below the surface. Then it is polished on wet lead laps. Alternately, the sample is polished to a mirror finish with a soft abrasive, so finely divided that when shaken in water it will take a half hour to settle, and lightly etched with acid to bring out the grain boundaries. This dual process is continued until no disturbed metal is seen under the microscope.

The operator of the micro-hardness tester then places the sample under the microscope on a movable bedplate and selects the grain or area to be tested. When this is determined, the sample is transferred to the penetrator mechanism. The penetrator arm, balanced with its adjustable weight suspended on knife-edges, slowly bears down to make the indentation. After the indentation has been made, the sample is moved back under the microscope and examined. Indentations may range upward of 2 microns in depth, depending on the hardness of the sample.

The micro-hardness tester measures with amazing accuracy the hardness of steel grains themselves, and of the iron and other alloy carbides. It is now in continuous use at the Kearny, N. J., laboratory of the United States Steel Corporation, where studies are being made of the microscopic constituents of steel.

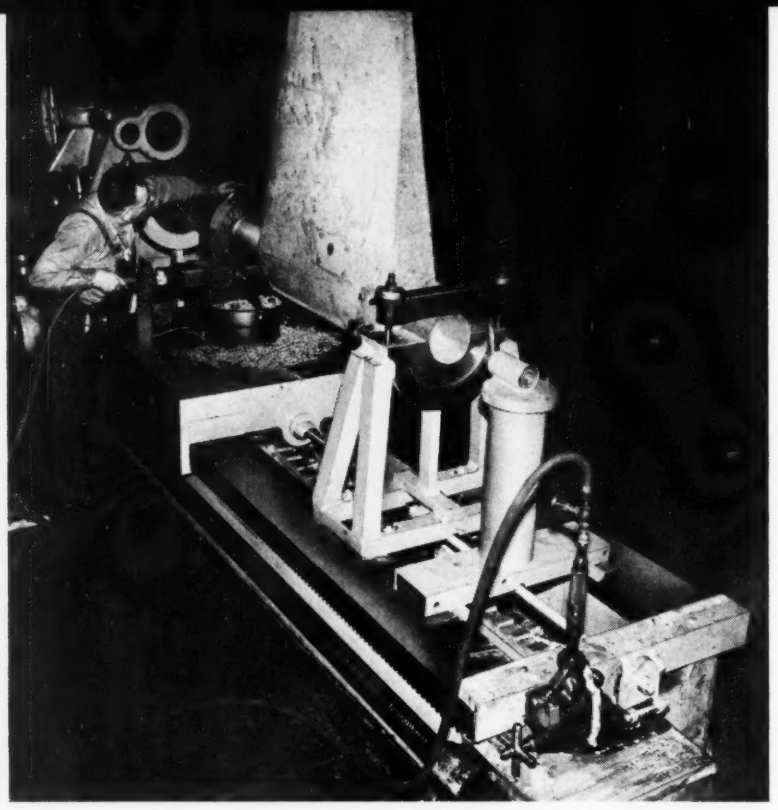
Improved Method of Electroplating Tungsten Alloys

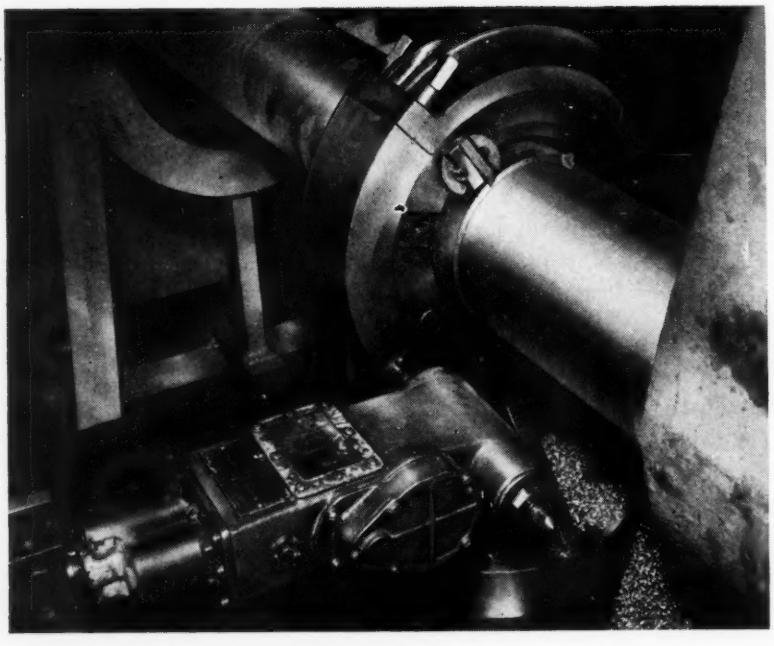
A new method of producing electrodeposits of tungsten alloys on metal surfaces—and thereby improving their hardness at elevated temperatures—soon may be applied to dies, molds, cutting tools, and machine parts. This method, developed by the National Bureau of Standards, permits electroplating of iron tungsten, cobalt tungsten, or nickel tungsten in thicknesses up to 0.02 inch on steel.

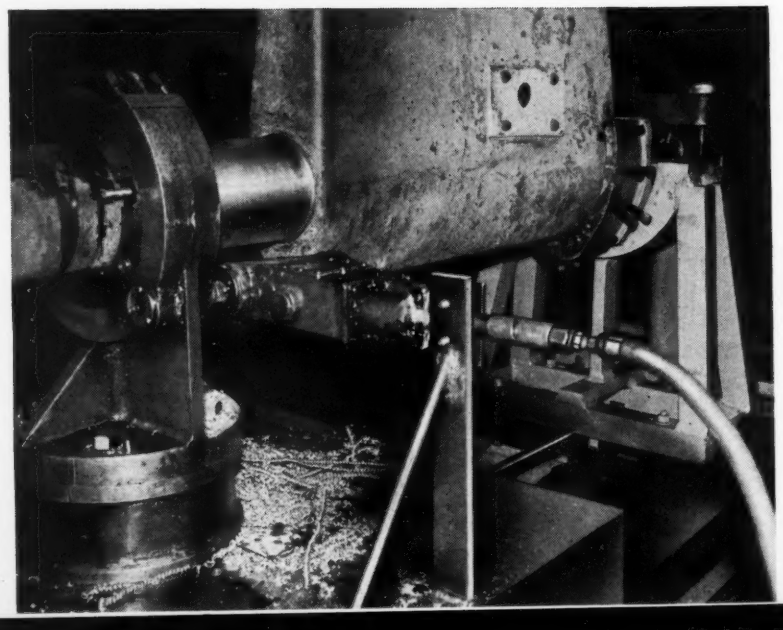
Of the alloys investigated, cobalt tungsten, which resembles the alloy Stellite in some of its properties, was found to plate most easily. A typical solution for depositing this material contains 25 grams per liter of tungsten (as sodium tungstate), 25 grams per liter of cobalt (as cobalt chloride or sulphate), 400 grams per liter of Rochelle salts, 50 grams per liter of ammonium chloride, and sufficient ammonia to provide a pH of 8.5 to 9. Plating takes place at a temperature above 90 degrees C. and at a current density of from 2 to 5 amperes per square decimeter. The Rochelle salts may be replaced by salts of other organic hydroxy acids. As anodes, either tungsten, the appropriate iron-group metal, or a tungsten alloy may be employed. The solutions for depositing the iron- and nickel-tungsten alloys are very similar.

The maximum percentages of tungsten that may be obtained are 35 per cent in the nickel alloy, about 50 per cent in the cobalt alloy, and approximately 60 per cent in the iron alloy. However, for sound alloys of desirable properties, the tungsten content must be lower than the maximum; for example, the cobalt alloys should have not more than 30 per cent of tungsten. The untreated nickel- and cobalt-tungsten alloys may have a hardness of between 400 and 700 on the Vickers scale. The iron alloy has an even greater hardness, ranging from 700 to 900 Vickers; it is thus comparable in hardness to electrodeposited chromium.

Unlike most other electrodeposits, which soften with heat-treatment, these alloys may increase 100 points or more in hardness upon heating to 600 degrees C. The cobalt-tungsten alloy is of further interest in that it maintains a fair degree of hardness even at quite elevated temperatures. For example, at 700 degrees C., the hardness of a carbon steel drops to about 50 on the Vickers scale, whereas the cobalt-tungsten alloy at this temperature has a hardness of over 290 Vickers.







Attachment for Turning Rudder Shafts

By JOSEPH CLEMENT and J. A. KRUSE
U. S. Navy Yard, Pearl Harbor, T. H.

SHAFTS supporting integral rudders and other similar-shaped parts that ordinarily require lathes having a large swing can be turned on lathes with long beds but restricted swings by means of the attachment here described. The attachment can be mounted on the end of the lathe bed, and its use will not interfere with the separate use of the lathe headstock for other work not requiring the full bed length. It is quickly and easily attached to and removed from the lathe.

As shown in Fig. 1, the attachment consists essentially of two steadyrests and a small carriage that supports a rotating tool-head. The tool-head is mounted in a stationary split housing, and driven through enclosed gearing by a pneumatic motor having a right-angle drive, as shown in Fig. 2. The independent carriage feed incorporated in this attachment is also driven by a right-angle drive pneumatic motor through a worm drive mounted at the tailstock end of the lathe bed.

The steadyrests accommodate interchangeable split bushings that fit the various size rudder shafts. A cradle with adjusting screws is provided on the tailstock steadyrest, as shown in Fig. 3, for adjusting and aligning the shaft.

Fig. 1. (Top) Lathe Attachment for Turning Rudder Shafts

Fig. 2. (Center) Close-up View of Cutting Tool, which Revolves about the Stationary Rudder Shaft. The Tool-holder is Rotated by Gearing Connected to the Pneumatic Motor Shown in the Foreground

Fig. 3. (Bottom) The Tailstock Steadyrest Shown in the Background is Provided with a Cradle Containing Adjusting Screws for Aligning the Rudder Shaft

Annual Meeting of the A.S.M.E. Unusually Successful

THE annual meeting of the American Society of Mechanical Engineers, held at the Chalfonte-Haddon Hall in Atlantic City during the first week in December, was considered by many of the members present as one of the most successful meetings held by the Society. Every branch of mechanical engineering received attention in the seventy-four different sessions held during the five meeting days, and over three hundred speakers outlined their ideas on mechanical engineering subjects during these sessions. Approximately one hundred committees on standards, research, test codes, and other mechanical engineering subjects also met during the week of the convention. The registration at the meeting numbered 3150 engineers.

Among the sessions held, those of particular interest to readers of MACHINERY dealt with applied mechanics, industrial instruments and regulators, education for the industries, production engineering, metals engineering, materials handling, machine design, management, safety in the industries, lubrication, effect of temperature on metals, and the mechanical engineering side of railroading.

The papers read at the four sessions on production engineering will be briefly referred to in the following paragraphs:

E. P. Bullard, III, vice-president in charge of manufacturing, Bullard Co., Bridgeport, Conn., presented a paper on "A Recent Development in Automatic Lathe Control." The operation and performance of a three-spindle automatic lathe, developed to meet the need for a machine capable of automatically performing, with a minimum of special tooling, the large variety of turning operations normally handled on a standard engine lathe, were described.

The history and development of surface broaching was covered by Oliver W. Bonnafe, chief research engineer, Lapointe Machine Tool Co., Hudson, Mass. In this paper, the speaker also outlined the methods by which a number of unusual broaching operations are being performed.

Gerald Von Stroh, assistant manager of the development engineering department, Lukens Steel Co., Coatesville, Pa., read a comprehensive paper entitled "A Clinical Approach to Weldment Design." He presented a study of welding failures in much the same manner as a physician approaches a human ailment and learns from it how medical difficulties may be overcome. Specific examples of weldment failures—their causes and possible cures—were considered. The welded parts discussed ranged from those used in heavy industrial and railroad equipment to lighter parts such as are employed in the automotive field.

Another paper relating to the welding field was presented by Charles A. Davis, engineer, and Wilfred C. Cadwell, supervisor of material specifications of the Caterpillar Tractor Co., Peoria, Ill. In this paper, entitled "Production of All-Welded Tractor Frames and Clutch Cases," the authors showed how welding has been successfully applied on a production basis to the fabrication of tractor parts. Details of the specifications controlling design and production were described and illustrated. The general design, production, and inspection methods were also covered.

One of the production engineering sessions dealt exclusively with quality control. At this meeting, two papers were read—one by C. W. Kennedy, quality control engineer of the Federal Products Corporation, Providence, R. I., who, in his paper entitled "A Discussion of Modern Quality Control Techniques," briefly outlined the history and development of statistical quality control methods. The practice of statistical methods using variables and using the laws of chance was described. The technique of "sampling" was taken up, sampling tables were presented, and procedures used in a large number of plants were described. The methods outlined aid in reducing scrap and remachining. On a kindred subject, E. E. Folsom, engineer of quality control activities, General Electric Co., Bridgeport, Conn., presented a paper entitled "Practical Applications of Quality Control," which contained specific references to successful methods now being employed.

One of the sessions of the Production Engineering Division, conducted jointly with the Machine Design Division, consisted of a panel discussion on "Design for Production." At this session, brief papers were presented by several engineers. George G. Landis, vice-president in charge of engineering, Lincoln Electric Co., Cleveland, Ohio, introduced the subject in a paper entitled "Design for Production." This

was followed by a brief address by P. C. Smith, assistant to division manager, Transportation and Generator Division, Westinghouse Electric Corporation, who discussed "Coordination of Design and Manufacture in the Transportation and Generator Division of Westinghouse."

L. M. Clement, director of research and engineering, Crosley Division, Avco Mfg. Corporation, Cincinnati, Ohio, spoke on "Product Design for Economical Manufacture," while F. O. Hoagland, master mechanic, Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., dealt with the trend in design for production as indicated at the recent Machine Tool Show in Chicago. C. Cuthbertson, assistant superintendent of manufacturing engineering, Western Electric Co., Kearny, N. J., discussed the specific case of "Coil Re-Design for Production," while A. F. Murray, works manager, Electrolux Corporation, Old Greenwich, Conn., dealt with the details to observe in volume production of domestic appliances and other small products. The title of his address was "It's the Little Things that Count."

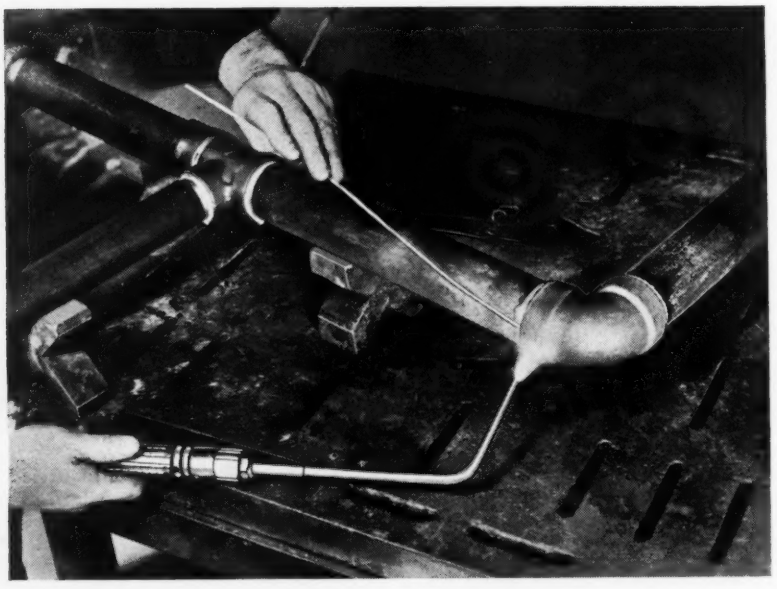
The committee meetings held during the convention dealt, among other subjects, with milling cutters; working ranges of small tools; revision of the American Standard screw threads; single-point tools; twist drill sizes; carbide-tipped milling cutter bodies; bolt, nut, and rivet proportions; metal-cutting data; cutting fluids; lubrication; small tools and machine tool elements; Acme and stub-Acme threads; and buttress screw threads.

Pipe Fittings without Threads Assembled by Brazing

MALLEABLE-IRON socket type fittings designed to be brazed to steel or wrought-iron pipe instead of being connected by threads, as in conventional practice, have been placed on the market by Stanley G. Flagg & Co., Inc., Philadelphia, Pa. These Flagg-Flow threadless fittings are reamed to accommodate the outside diameter of standard pipe and also to produce a shoulder or stop for the pipe when it is inserted in the fitting. The pipe end must be machined fairly accurately by means of a hand-operated tool, so as to insure just the required amount of clearance between the pipe and the fitting. This can be done in the field just as readily as pipe threading.

In making an installation, silver brazing alloy is put on the inside of the fitting socket and on the outside of the pipe. Then after the pipe has been inserted in the socket, heat is applied by an oxy-acetylene torch to melt the solder. Capillary action is said to insure complete flow of the solder throughout the joint, giving a joint which is claimed to be stronger than the pipe itself. The silver soldering alloys used for this work require temperatures of 1160 degrees F. and higher.

One of the principal advantages of this new type of fitting is that it permits the utilization of the full wall thickness of pipe in planning installations, since the pipe is not weakened by threads. Another important advantage is that the internal diameter of the Flagg-Flow fittings is constant and the same as that of the pipe, so that there is no enlarged chamber such as exists in threaded fittings, which increases resistance to the flow of liquid or steam through the pipe because of turbulence set up by the chamber. These threadless fittings are being manufactured in a range of sizes from 1/4 inch to 2 inches.



The Final Step in Making a Flagg-Flow Joint Consists of Applying Hard Solder and Heat to Both the Pipe and Fitting by Moving the Oxy-acetylene Flame back and forth across the Joint until the Solder Flows into the Clearance between the Pipe and Fitting

Drawing Thin-Walled Shells of Intricate Shape

By DONALD A. BAKER

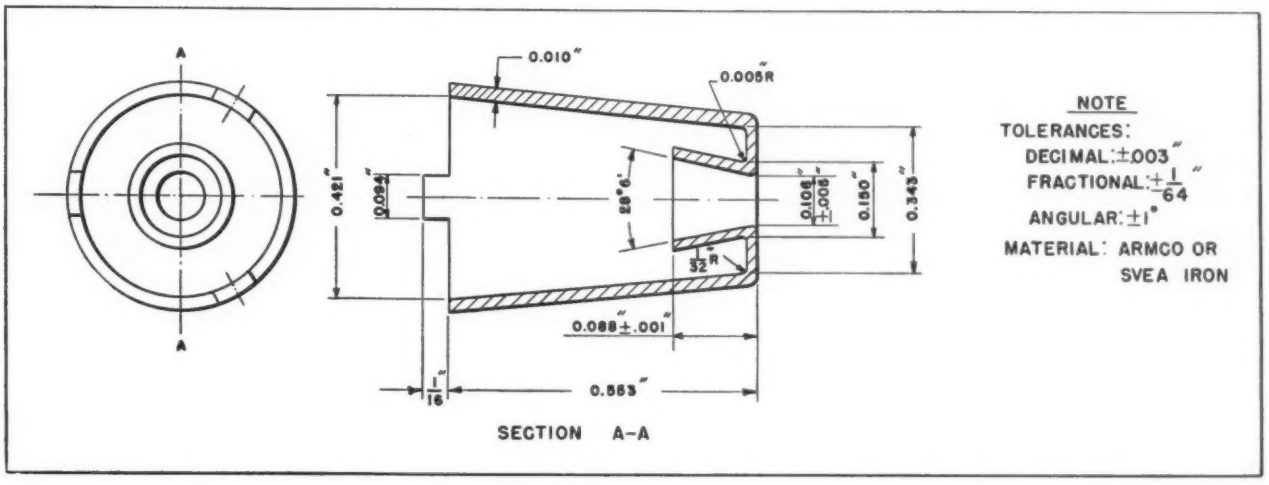


Fig. 1. Thin-walled Radio-tube Part that Presents Three Types of Drawing Problems—Drawing the Inside Boss, Drawing the Main Shell, and Expanding the Boss

SMALL radio-tube parts and thin-walled shells for other precision assemblies, because of their intricate shape, must be formed by a series of drawing operations, the number and severity of which are determined largely by experience. The design of the various punches and dies requires careful coordination.

The steel part shown in Fig. 1 is typical of work of this kind. It presents three different types of drawing problems—first, the drawing of sufficient metal away from the main body of the blank to form the small inside boss; second, the drawing of the main shell; and third, the expanding operation on the boss.

Development work on this part was performed on small hand arbor presses equipped with gibs for taking the play out of the ram. As with most work of this kind, the punches and dies were left soft for the initial short runs, but for later production runs, the dies were hardened. In all cases, the drawing punches and dies were given a high polish on their working surface, the final polish being in the same direction as the draw, which made the stripping action easier.

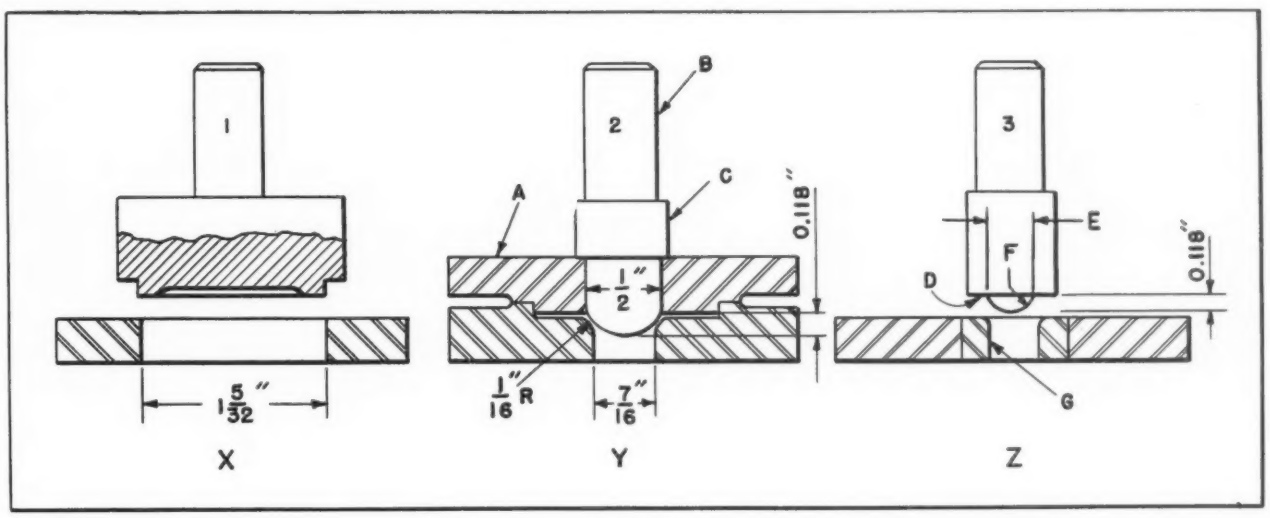


Fig. 2. (X) Die Used to Blank out the Steel Sheet for the Shell. (Y) First Punch and Die for Drawing the Boss. (Z) Second Drawing Die for Producing Boss. All Subsequent Dies Have Standardized Outside Diameters

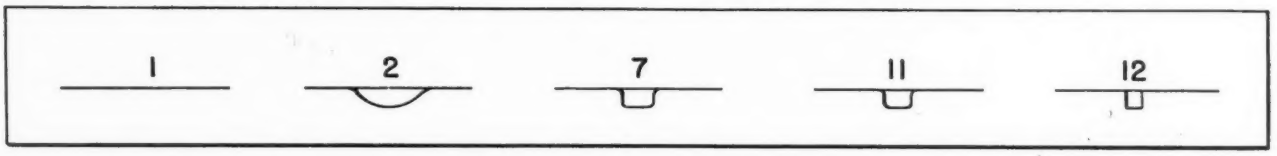


Fig. 3. Twelve Draws are Required to Shape the Boss. The Five Principal Stages, Shown Here Schematically, Correspond to the Operations Listed Numerically in Table 1

Because of the complexity of the contour of the part, the standard tables and usual formulas for determining blank diameters were of little use, and the first blanks were cut with hand shears. It was only after several cups had been drawn, and the required blank size determined by actual observation, that the blanking die, shown at *X* in Fig. 2, was constructed. Note that the face of the punch was slightly cupped to make peening easier in case the surface was damaged in the blanking operation. After peening, the punch could then be sheared through the die without damaging the hardened die edge.

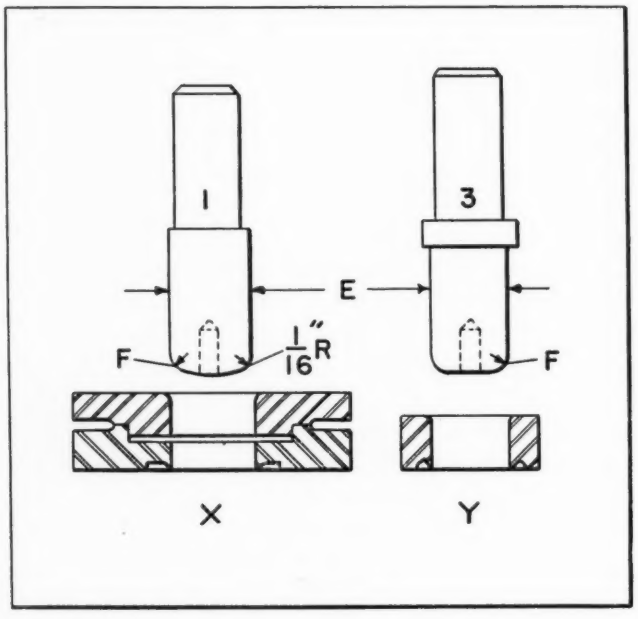


Fig. 4. (X) All the Punches for Drawing the Shell are Drilled to Provide Clearance for the Boss and to Center the Blank. The Dies for Drawing Operations 4 to 10, Inclusive, are Similar in Construction to that Shown at Y, which is Used for Operation 3

Table 1. Punch Sizes for Drawing Boss on Part Shown in Fig. 1

Operation Number	Punch Diameter E (Fig. 2)	Chamfer Radius F on Punch (Fig. 2)
3	0.350	0.133
4	0.305	0.122
5	0.265	0.091
6	0.225	0.070
7	0.190	0.053
8	0.160	0.033
9	0.140	0.028
10	0.120	0.018
11	0.101	0.010

The first drawing die to be designed was the one for the boss; its general construction is shown at *Y* in Fig. 2. This die was not recessed to form a blank-holder, as shown in the illustration, until after the final blank diameter had been determined. Instead, it was used as a flat plate, with a properly shaped and polished hole in the center and with a pressure plate *A* on the top; as will be explained later, the pressure on the blank was regulated with holding clamps. Locating of the work over the die was done by eye.

It will be noted that the height of the draw in this die was 0.118 inch, although the specifications called for an inside boss of but 0.088 inch. This liberal allowance was made so that the part could later be trimmed to the exact length required. For this reason, all the punches in the series were made the same length. In other words, it was necessary to make the first draw to the full height of the finished part, as little success could be expected in trying to stretch the metal in subsequent operations. The first drawing punch *B* had a shoulder *C* that stopped the punch on the upper face of the pressure pad and thus controlled the depth of draw, while the rest of the punches, one of which is shown at *D* in view *Z*, had a large shoulder to eliminate any tendency of the metal to wrinkle and to keep the blank flat.

Table 2. Punch Sizes for Drawing Shell Shown in Fig. 1

Operation Number	Punch Diameter E (Fig. 4)	Chamfer Radius F for Punch (Fig. 4)
3	0.605	0.150
4	0.540	0.125
5	0.480	0.099
6	0.447	0.082
7	0.418	0.068
8	0.385	0.051
9	0.360	0.039
10	0.342	0.030

The punch and die shown at *Z* performed Operation 3 (the second drawing operation).

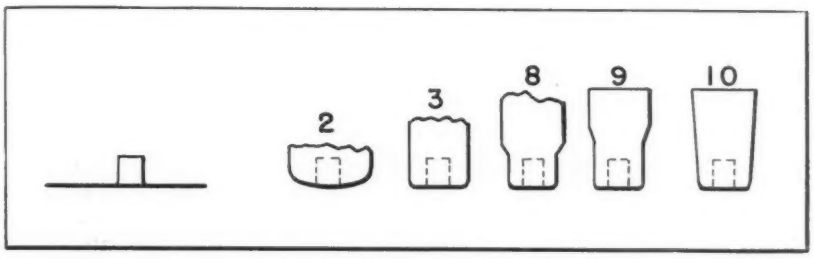


Fig. 5. Ten Drawing Operations are Required to Produce the Shell. The Stages Here Indicated Correspond to Those Listed in Table 2 or Shown in Fig. 4

Dimension *E* and radius *F* were made as small as possible without putting an undue strain on the metal. With work of this kind, it is always best to add another operation if the metal shows signs of stress or a tendency to fracture. The second draw is a good index of what the metal will stand, and the remaining dies and punches can be made with a diminishing ratio of punch diameter to punch radius as the diameter of the draw grows smaller. A little study of Table 1, which lists the punch diameters and radii for the remainder of the boss-drawing punches will illustrate this point. Fig. 3 shows the principal steps in the sequence of operations required for drawing the boss.

The outside diameter of the dies was standardized so that they were an easy slip fit in the soft steel locating plate; this aided in removing the blanks that clung to the dies and had to be wrung off.

With the boss-drawing series of dies, an extra die was used with the last punch. This die was for producing the 0.005-inch radius on the boss. (Actually, the last die had two faces, one side with a larger radius and the other side with a smaller one, so that it could be turned over for the final operation.) The face of the die had practically a sharp edge—it was touched only lightly with a stone—and was highly polished.

To relieve the stress in the metal before subjecting it to another drawing operation, the blanks were annealed in a controlled-atmosphere furnace. They were then cupped in the die shown at *X* in Fig. 4; this die—the first one for drawing the shell—was also designed without a blank-holder recess, which was added later after the final diameter of the blanks was determined. The distance between the faces of the pressure pad and the die was equal to the exact thickness of the metal in the blank.

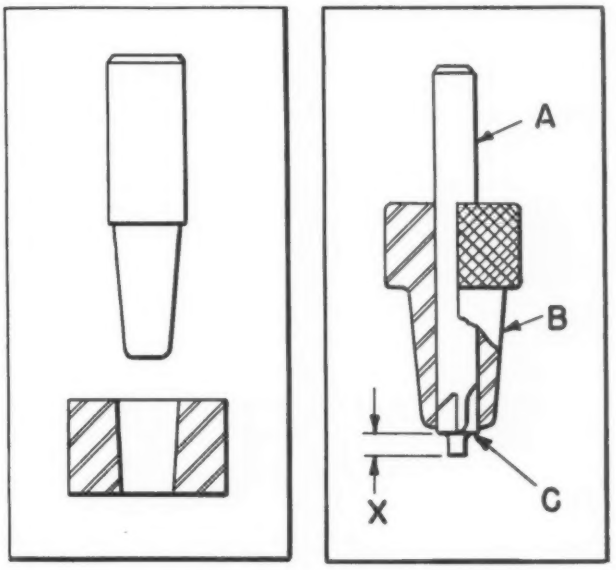


Fig. 7. (Left) The Last Punch and Die in the Series is Made to the Exact Diameter, Taper, and Length Required for the Finished Work. Fig. 8. (Right) A Guide Bushing B was Used to Center and Guide Counterbore A, as well as the Punch Used for the Expanding Operation that Followed

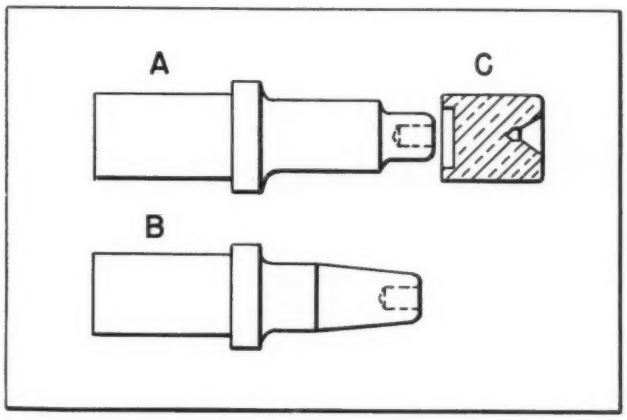


Fig. 6. Mandrels for the First and Second Trimming Operations. The Brass Piece C was Used to Hold the Parts against the Ends of the Mandrels

Other dies in the series, which either are shown in Fig. 4 or listed in Table 2, were planned in the same manner as those for the boss-drawing dies. A center hole was drilled in all the punches to provide clearance for the boss and to center the blank for the following operations, and the radius of one punch was designed to blend with that of the next, so that less stress was put on the metal.

This series of operations resulted in the various cup shapes indicated in Fig. 5. Following the use of the 0.418-inch punch (Operation 7), two punches were used to produce shape No. 9 in Fig. 5. Care had to be taken at this point, since a slight difference in the position of the

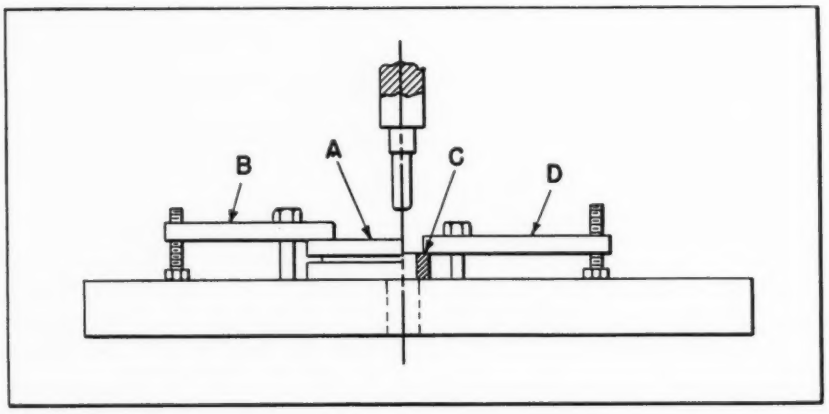


Fig. 9. Dies were Held in the Arbor Press by Two Clamps B. Half of the Blanking and First Drawing Dies is Indicated at A. Subsequent Dies and Clamps are Represented by C and D, Respectively

shoulder would cause trouble in the final taper die.

Following these operations, the shells were trimmed to length on a lathe. They were made just a little shorter than the finished part, and were then put in the die shown in Fig. 7. This punch was made to the exact diameter, taper, and length called for by the specifications, so that it was necessary only to place the work on a hardened plate and force the punch down as far as it would go. Both the die and the punch were highly polished, as the slightest scratch or groove running around either would cause the parts to stick; and with this thin stock, it was almost impossible to remove the shells without damage. Mandrels for the first and second trimming operations are shown by *A* and *B*, Fig. 6. The brass piece *C* was used to hold the parts against the end of the mandrel; it was positioned by a ball-bearing center that was forced against it with the lathe tailstock. Trimming was done with a sharp-pointed lathe tool.

In Fig. 9 is shown the arbor press as it was arranged to handle this job. *A* represents half of the blanking and first drawing dies, and *B* one of the two clamps used to hold them in position; *C* indicates another type of drawing die (such as shown in Fig. 7) which is held on its edges by two clamps similar to *D*.

Upon the completion of this stage in the cup-drawing operations, the boss was drilled from the outside of the shell by using a drill that just fitted inside the boss. Next the counterbore *A*, Fig. 8, guided by the hardened bushing *B*, was brought into use, and the inside of the boss was

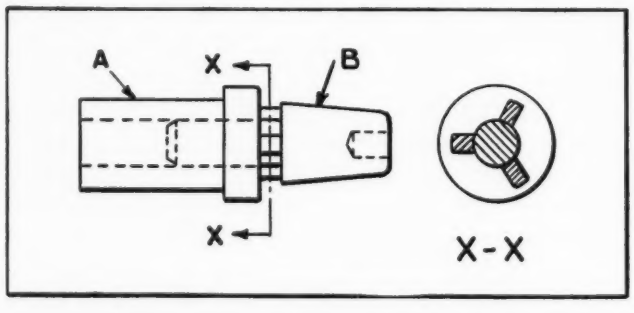


Fig. 10. Mandrel Used to Hold the Shell while Cutting the Lugs on the End

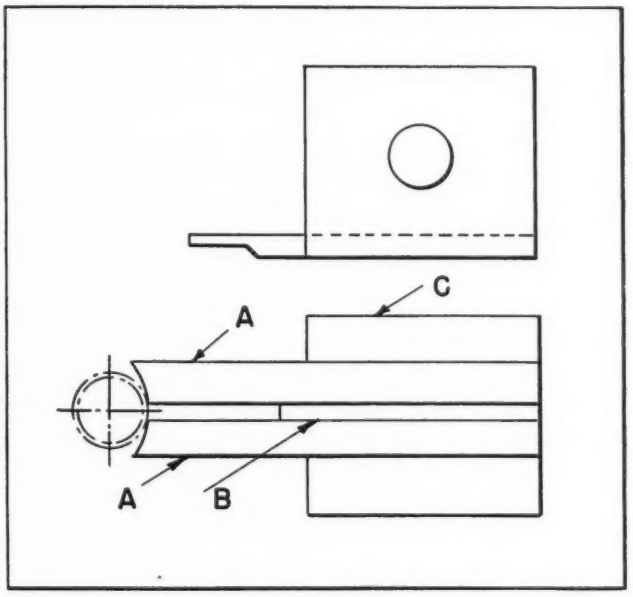


Fig. 11. Special Tools Used in Machining the Lugs on the End of the Shell

rough-faced. For this operation, the shell was held on a hardened plate so that the length *X* of the pilot determined the depth to which the counterbore would enter the hole. The first counterboring operation left the boss long enough so that after the following operation (in which the boss is expanded to produce the taper) there would be enough stock left to face the part to the exact length required. The counterbore was made with a slight radius at *C* to leave a smooth rounded corner on the work and remove ragged edges from which cracks might develop.

Expanding of the boss was the next step in the operations; this was done on a small drill press, that was employed as an arbor press. The punch used for this operation was guided by the

bushing *B*, Fig. 8, in the same way as the counterbore was. When positioned in the bushing and pressed down to the hardened plate, the punch expanded the bore to the exact size and taper required. Then the boss was finished to length with a suitable counterbore.

The burrs on the outside edge of the boss were removed with a special cylindrical filing tool, on the inside diameter of which teeth were cut with a hand chisel, and later hardened.

The next step in the production of the part consisted of machining the three lugs on the top of the cup. This operation was performed on a lathe having an index-plate on the large headstock gear, which could be indexed to give three equal divisions. First, the shell was placed over a special mandrel, Fig. 10, and held by pressure applied with the tailstock of the lathe. This mandrel consisted of a shank *A*, on which were machined the projections shown by the cross-sectional view, and a nose-piece *B*. Two tools *A*, Fig. 11, separated by a spacer *B* the same width as the projections and the lugs, were held in a special tool-block *C*, mounted on the cross-slide of the lathe, which was actuated by turning the lathe handwheel. These tools were used to machine the end of the shell hanging over the nose-piece of the mandrel by reciprocating the lathe cross-slide, thus planing off the material overhanging the nose-piece and leaving only the three lugs intact.

* * *

Profile Gage Problem

By HENRY R. BOWMAN

The following profile gage problem was encountered in connection with the manufacture of an ordnance shell. In mathematical terms, the problem was essentially to locate the center of an arc of radius *c*, as shown in the accompanying diagram, so that it would be tangent to a straight line that made an angle *D* with the horizontal and would also pass through a point that was located at a given horizontal distance *b* from the reference point *O*. This point is located at a given vertical distance *a* from the inclined line.

Let *m*, *n*, *p*, *s*, *t*, *E*, and *F* be dimensions and angles as shown in the diagram, and *x* and *y* the horizontal and vertical distance, respectively, of the center of the arc from the reference point *O*. The problem is, then, to find *x* and *y*. Referring to the diagram,

$$m = b \tan D \quad (1)$$

$$n = a - m \quad (2)$$

$$p = n \cos D \quad (3)$$

$$s = c - p \quad (4)$$

$$\text{Cos } E = \frac{s}{c} \quad (5)$$

$$F = D + E \quad (6)$$

$$t = c \sin F \quad (7)$$

$$x = b - t \quad (8)$$

$$y = c \cos F \quad (9)$$

Example—Assume that $a = 2\ 11/16$ inches, $b = 7$ inches, $c = 8$ inches, and angle $D = 10$ degrees; find dimensions x and y.

$$m = 7 \times \tan 10 \text{ deg.} = 7 \times 0.17633 \quad (1)$$

$$m = 1.23431 \text{ inches}$$

$$n = 2.6875 - 1.23431 = 1.45319 \quad (2)$$

$$p = 1.45319 \cos 10 \text{ degrees} = 1.45319 \times 0.98481 \quad (3)$$

$$p = 1.43112$$

$$s = 8 - 1.43112 = 6.56888 \quad (4)$$

$$\text{Cos } E = \frac{6.56888}{8} = 0.82111 \quad (5)$$

$$E = 34 \text{ degrees } 48.24 \text{ minutes}$$

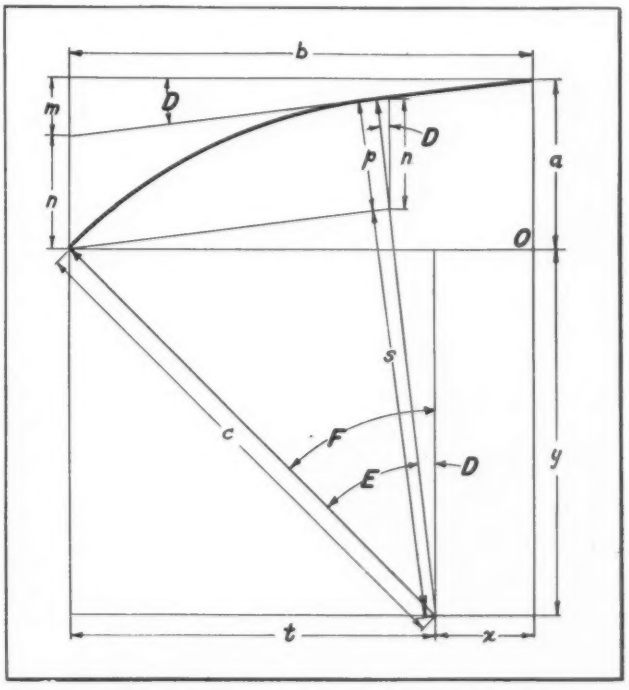
$$F = 10 \text{ deg.} + 34 \text{ deg. } 48.24 \text{ min.} = 44 \text{ deg. } 48.24 \text{ min.} \quad (6)$$

$$t = 8 \text{ sin } 44 \text{ deg. } 48.24 \text{ min.} = 8 \times 0.70468 \quad (7)$$

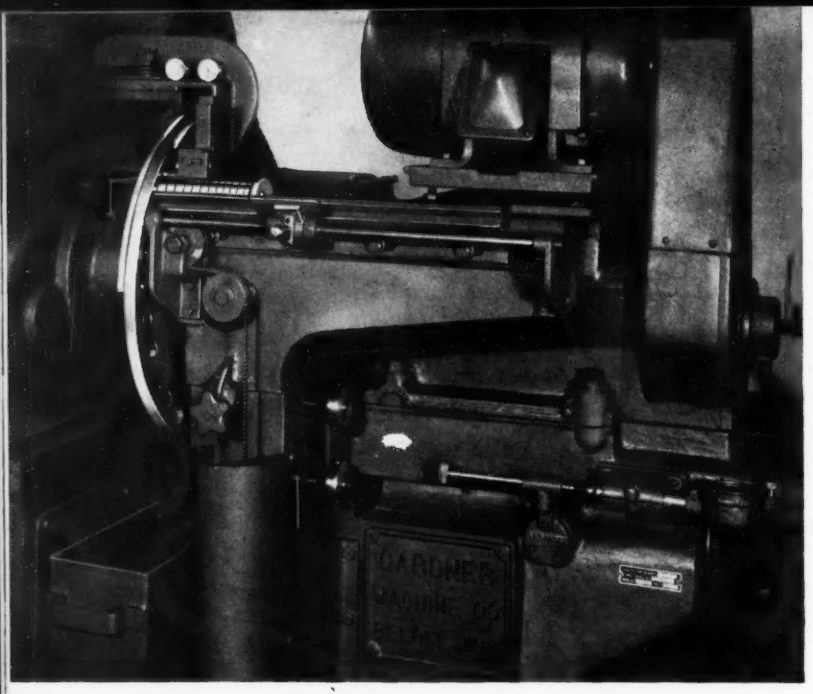
$$t = 5.63744$$

$$x = 7 - 5.63744 = 1.36256 \text{ (or } 1.3626 \text{ inches)} \quad (8)$$

$$y = 8 \times \text{cos } 44 \text{ deg. } 48.24 \text{ min.} = 8 \times 0.70952 \text{ (or } 5.6762 \text{ inches)} \quad (9)$$



Profile Curve Required to be Tangent to Straight Line that is at an Angle D with the Horizontal and to Pass through a Point at Horizontal Distance b from Point O



Fixtures that Surface

Rotary Type Carriers, "Feed-Through" Fixtures, and Hydraulically Oscillated Sliding Tables have Greatly Increased the Fields of Application and Production of Double-Spindle Grinders

DOUBLE-SPINDLE grinders are generally used to grind two opposed parallel surfaces on a part simultaneously or a single surface on two different parts at one setting. There are many methods of passing the work to be ground between the wheels of such machines. A few examples of the variety of work-holding and feeding fixtures that tend to increase the production attainable from such grinding machines are described in this article.

Rotary type work-carriers provide one of the most productive methods of grinding parallel-surface parts on double-spindle disk grinding machines. Various methods of loading, clamping, and unloading are adaptable to this type of grinding, the choice generally depending upon the shape of the part to be ground and the production required.

A horizontal trough type feeder is used in conjunction with a rotary type work-carrier to grind the two parallel sides of steel check valve blocks on the Gardner double-spindle grinding machine shown in Fig. 1. From 0.004 to 0.006 inch of stock is removed from each part, flatness and parallelism of the sides being maintained within 0.0005 inch. A production of thirty pieces per minute is attained in this operation.

The valve blocks are stacked by hand into the horizontal trough of the feeding attachment. A weight-actuated slide exerts pressure against the outer end of this stack, holding it in contact with the face of the work-carrier. As the carrier

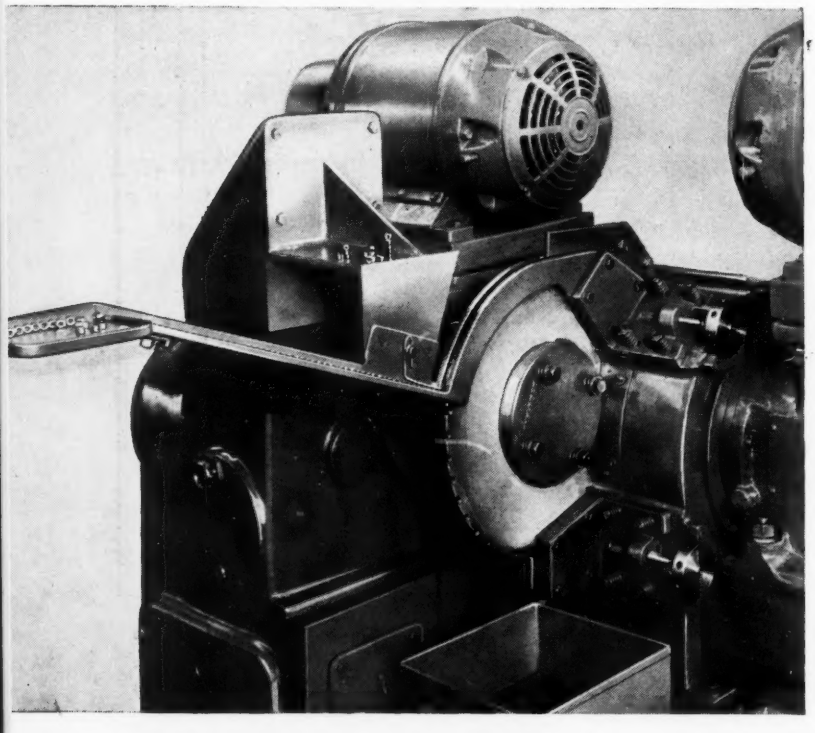


Fig. 1. (Above) Valve Blocks Placed in the Horizontal Trough are Automatically Fed into the Holes Located Near the Periphery of the Rotary Work-carrier of a Gardner Grinder

Fig. 2. (Left) Small Ball-bearing Races Drop from the Inclined Chute into the Notches around the Periphery of a Rotating Carrier Plate

Increase Production in Parallel-Grinding

By R. D. GARDNER, Chief Engineer
Gardner Machine Co., Beloit, Wis.

rotates, the pieces are automatically fed, one at a time, into the holes located near the periphery of the carrier plate. Micrometer-adjusted guides locate each piece properly before it is carried between the opposed grinding disks. A spring-actuated ejector automatically unloads each part as it passes from between the grinding disks.

Small-size, ball-bearing inner races are ground at the rate of eighty per minute by means of the notched type rotary carrier shown in Fig. 2. The operator need only keep the inclined chute filled with races, since each race automatically drops into a notch on the periphery of the carrier. A stationary peripheral guide, mounted between the abrasive disks, retains the races in their respective notches during the grinding operation.

For longer cylindrical parts, the notched type carrier is sometimes modified as shown in Fig. 3. Here the carrier consists of a circular plate having a series of V-blocks bolted to its periphery to accommodate steel piston pins from 3/4 inch to 2 3/8 inches outside diameter and from 2 1/4 to 6 1/8 inches long. A chain hold-down mechanism with adjustable tensioning device holds the pins in the V-blocks while they pass between two 26-inch diameter abrasive disks. After leaving the grinding disks, the parts, no longer being held by the chain, fall into the pan shown below the carrier. Production with this set-up varies from ten to fifty pieces per minute, depending upon the size of pin being ground.

"Feed-through" type fixtures enable the highest possible production of paralliel-surface parts to be attained on double-spindle grinders. The parts to be ground are fed by hand, belt, or rubber roll between the opposed grinding disks. The work is supported during grinding by thin steel bars, mounted both above and below the parts on adjustable brackets at the front and rear of the hood.

A V-belt type "feed-through" fixture, generally used for small light work, is shown in Fig. 4 mounted on a Gardner 15-inch grinder. In this operation, brittle composition washers are being ground at the rate of forty per minute, the parallelism being held to within 0.0005 inch. Parts placed in the inclined chute at the right roll down between a pair of V-belts which feed them between the grinding disks. Each V-belt is driven by a pair of rollers through a worm-gear reducer unit. One pair of rolls can be seen in the center, while the other pair (not visible) are on the far side of the chute. Parts are discharged from between the guide or support bars at the rear of the machine.

The rubber roll type of "feed-through" fixture is employed for odd-shaped parts or parts that are too large or heavy to be fed by a belt. An example of this type of fixture is the one shown

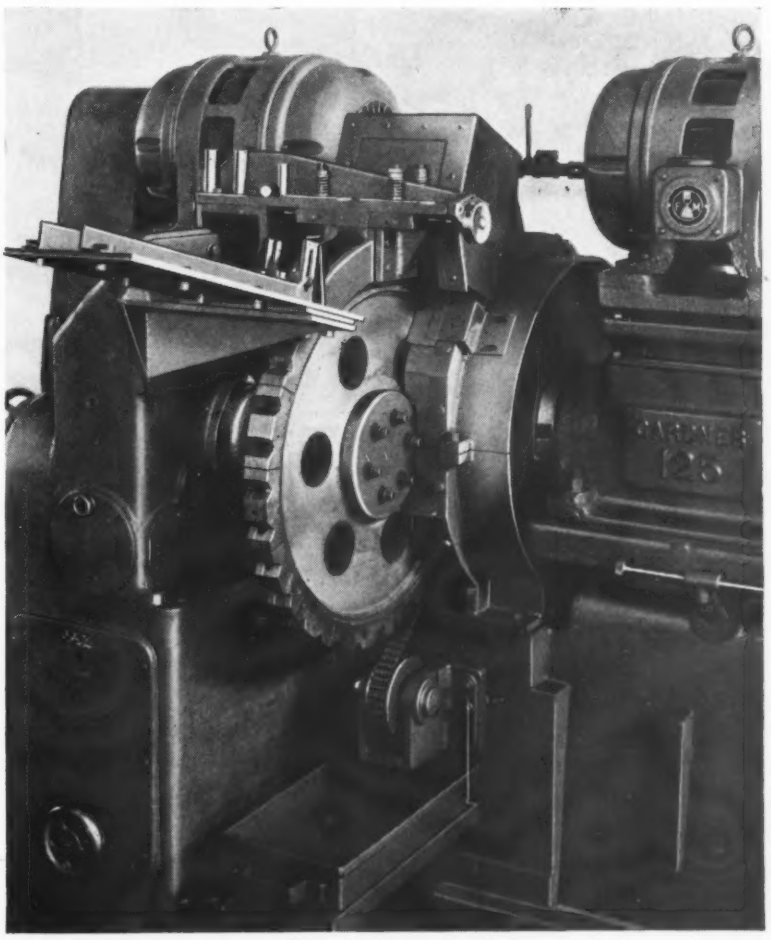


Fig. 3. Parallel Ends of Long Cylindrical Parts are Ground on a Double-spindle Machine by Means of the V-block Type of Work-holding Fixture Shown

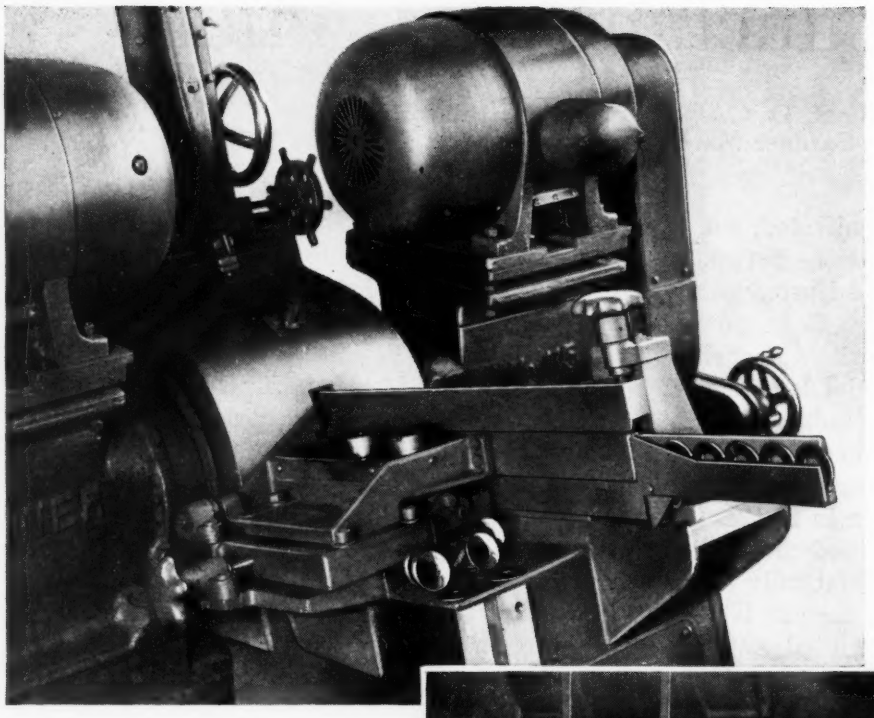


Fig. 4. V-belt Type of "Feed-through" Fixture for Feeding Washers between the Opposed Abrasive Disks of the Grinding Machine

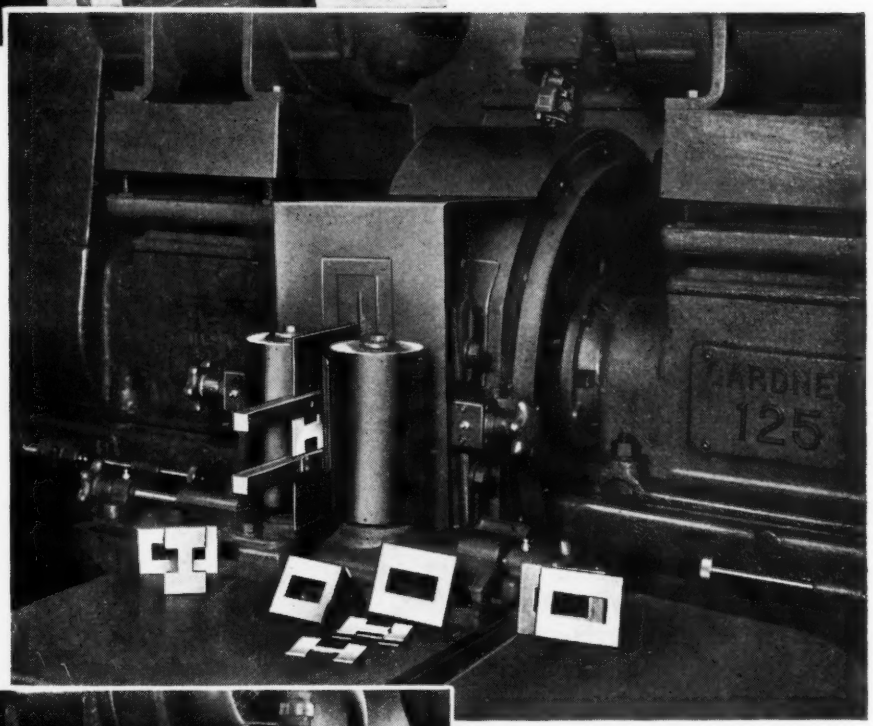


Fig. 5. Pump Vanes are Fed between the Grinding Disks of This Double-spindle Machine by Means of a Pair of Power-driven Rubber Rolls

Fig. 6. A Hand-operated, Roller Gun Type Sliding Fixture is Employed for Finish-grinding the Pump Vanes Shown in Fig. 5

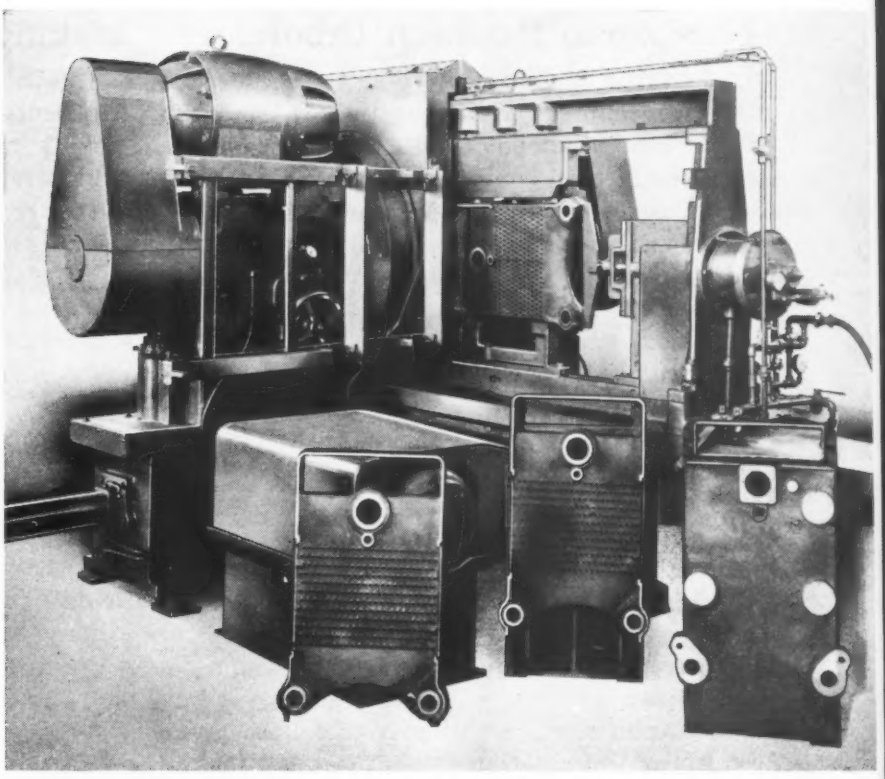


Fig. 7. Air-actuated Clamping and a Hydraulically Operated Oscillating Table are Employed on This Double-spindle Machine to Grind Boiler Sections

in Fig. 5, where Nitralloy pump vanes are seen being rough-ground at the rate of ten pieces per minute. Two passes between the grinding disks are required, and about 0.025 inch of stock is removed.

Two hard rubber feed-rolls are mounted on adjustable slides and driven by a worm-gear reducer unit. The upper and lower guide bars that support the work during grinding may be seen extending out between the feed-rolls.

The same Nitralloy pump vanes are finish-ground on another Gardner double-spindle grinder, as shown in Fig. 6. This machine is equipped with a hand-operated, roller gun type sliding fixture. Approximately 0.0025 inch of stock is removed, and a production of 125 pieces per hour is attained in this operation. Tolerances are held within 0.0005 inch for parallelism, 0.0003 inch for flatness, and 0.0007 inch for size.

Cast-iron boiler sections are ground at the rate of twenty per hour on the Gardner 40-inch double-head grinder shown in Fig. 7. The boiler sections are carried between the grinding wheels on a special air-actuated clamping fixture that is mounted on a hydraulically operated table. The work is located prior to clamping by means of a hinged gate, shown at the left swung out of position. The table oscillates automatically while the grinding-wheel heads are hydraulically fed toward the work. About 1/16 inch per side is removed from these parts the size being held to a tolerance of 0.010 inch and the parallelism to from 0.002 to 0.004 inch.

Goss & DeLeeuw Machine Co. Celebrates Twenty-Fifth Anniversary

On December 12, 1922, the Goss & DeLeeuw Machine Co. was formed in New Britain, Conn., for the production of automatic chucking machines. The original incorporators were Stanley T. Goss, who became the first president and treasurer and who still holds the office of president; Adolph L. DeLeeuw, who became the first vice-president and chief engineer and who died in 1942; and John S. Black, who became the first secretary and who is still secretary today. Twenty-five years later finds this concern a successful enterprise, operating a shop at Kensington, Conn., known the world over as a builder of modern types of chucking machines.

* * *

Motor that Runs at Over 200,000 R.P.M.

An experimental motor that runs at a speed of 204,000 R.P.M., and is designed for use in grinding holes under 1/16 inch in diameter has been built by the Bryant Chucking Grinder Co., Springfield, Vt. This high-speed motor is a three-phase induction type and operates on 3400-cycle current. The rotor is integral with the grinding-wheel spindle and is carried in precision ball bearings. These bearings are impregnated by oil mist, while the housing is cooled by a water jacket. The surface of the rotor travels at approximately 600 miles an hour.

New Airco Research Laboratory

A research laboratory devoted to the development of machinery and apparatus for the fabrication, heat-treatment, and refining of metals has recently been completed by the Air Reduction Sales Corporation at Murray Hill, N. J., to supplement the chemical and liquefaction laboratories of the company at Stamford, Conn.

The laboratory consists of a test and assembly area where experimental machinery and apparatus, and prototypes of production equipment will be made; a flame-proof area for conducting experiments in the combustion of gases and processing of metals; and a number of specially equipped sections, including a high-pressure oxygen laboratory and a compressed-gas cylinder testing laboratory.

Among the processes scheduled for extensive study are both gas and arc welding, oxygen cutting, gas-conditioning of metals, and inert-gas shielded arc welding. The gas flushing of impurities from steel, particularly tool steel, gives promise of eliminating many of the microfissures that often occur in small tools and cutters made of high-carbon steel. While the idea of shielding a welding arc with an inert gas is old, further research on the process has demonstrated its versatility for fabricating most of the ferrous and non-ferrous metals and alloys that have been considered difficult to weld. This has led to the development of improved types of equipment, one model of which is fully automatic and maintains a constant arc length, even when irregular-shaped sections are being joined.

Making of Small Dies Speeded Up

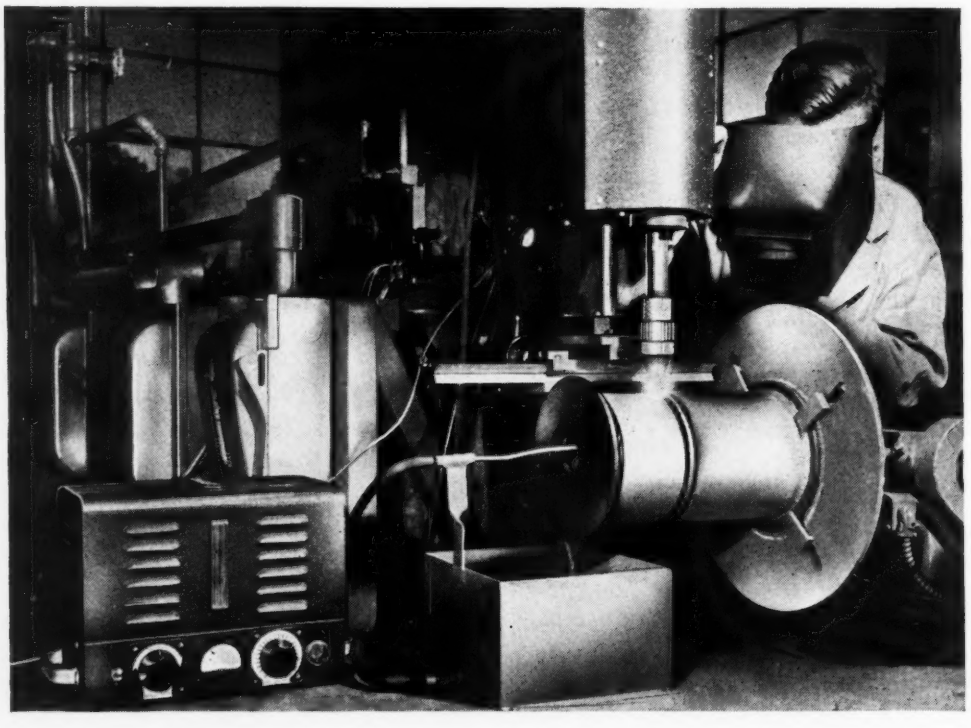
To speed up the making of small dies for experimental purposes, a metal so soft that it melts in hot water has been utilized by research engineers of the Ford Motor Co. The metal used —an alloy of bismuth, tin, and lead—is ordinarily too soft to withstand the pressures imposed on dies. This obstacle was overcome by freezing the die in liquid nitrogen—one of the coldest substances known—at a temperature of 320 degrees F. below zero. The freezing action increases the hardness of the surface from a consistency comparable to dried putty to the hardness of ordinary brass. From six to ten stampings can be secured between chillings in the frigid bath.

In the past, experimental engineers have had to wait from six to eight weeks for small steel dies to be made. With the aid of this alloy, soft metal dies are now produced and sample parts obtained in twenty-four to forty-eight hours.

* * *

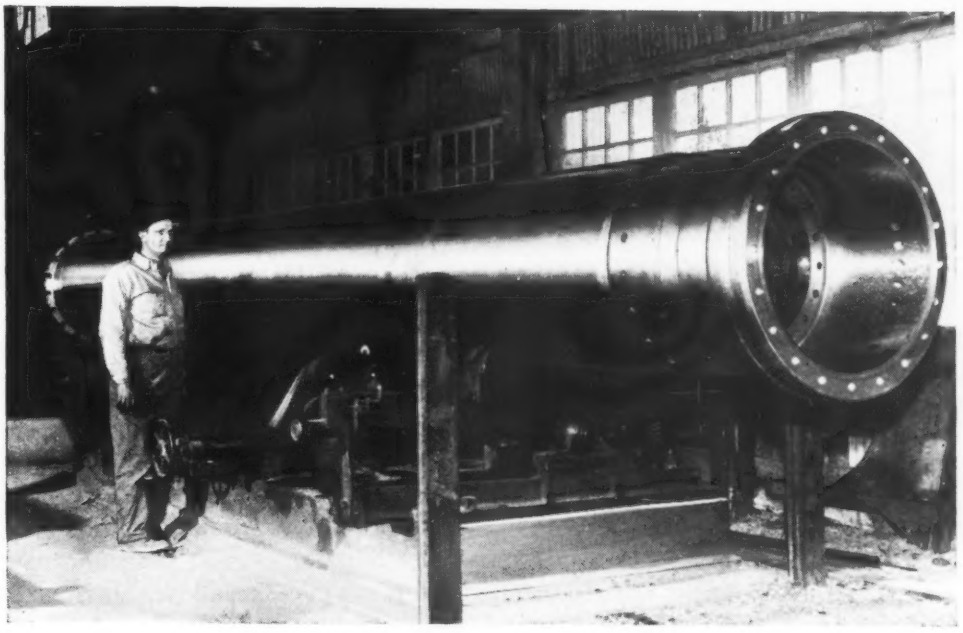
The World's Quietest Room

A room has recently been built by the Bell Telephone Laboratories for acoustical research, which is probably one of the quietest places in the world. The room eliminates 99.98 per cent of all sounds. To overcome sound reflection, the walls, ceiling, and floor are lined to a depth of 5 feet with wedges of Fiberglas, a sound-absorbing material which is made by bonding together glass fibers with Bakelite phenolic resins.



Heliarc Welding of Stainless-steel Drums with a New Fully Automatic Electronically Controlled Welding Head at the Apparatus and Machinery Laboratory of Air Reduction Sales Corporation

Centrifugal Casting of Carbon- and Stainless-Steel Tubes*



By J. W. MOORE and J. W. MacKAY
American Cast Iron Pipe Co.
Birmingham, Ala.

The Adaptation of the Cast Iron Centrifugal Casting Technique to the Casting of Carbon-Steel and Stainless-Steel Tubes has Resulted in a New Production Process

CENTRIFUGAL casting of high-alloy and carbon-steel tubes in heavy wall thicknesses was developed during the war to alleviate the shortage of fabricated tubes and pressure vessels. Since then the process has proved valuable as a means of supplementing the regular line of rolled and welded tubes. A variety of tube shapes—square, hexagonal, elliptical, or fluted—can be produced by the simple expedient of constructing suitable patterns.

The carbon-steel tubes produced by the American Cast Iron Pipe Co. range from 3 1/2 to 50 inches outside diameter and from 3/8 inch to 5 inches in thickness; they are cast in sand-lined molds in nominal lengths of 16 feet.

A minimum wall thickness for various outside diameters has been established. It is possible to produce centrifugally cast tubes with 1/4-inch walls in sizes up to 24 inches outside diameter; such tubes are usually furnished in lengths of from 4 to 9 feet.

No basic change in cast-iron pipe making machinery is needed to produce centrifugally cast steel tubes. Cylindrical cast-iron flasks approximately 16 1/2 feet long are set on end and centered on a rotating head that has a conical depression to receive the pattern; at the opposite end, the flask is centered by guide rollers. A metal pattern is lowered into the flask, and refractory sand is packed around the pattern by pneumatic hammers. The sand linings are 1 1/2 to 3 inches thick, depending on the flask size. After thorough ramming, the pattern is withdrawn, and the mold is air-dried, faced with a silica flour wash, and dried by a gas flame until the temperature on the outside of the flask reaches 250 degrees F.

Suitable stop-off plates are then keyed into the flask ends, after which the flask-mold combination is ready for the horizontal casting machine.

*Abstract of a paper presented before the American Society of Mechanical Engineers.

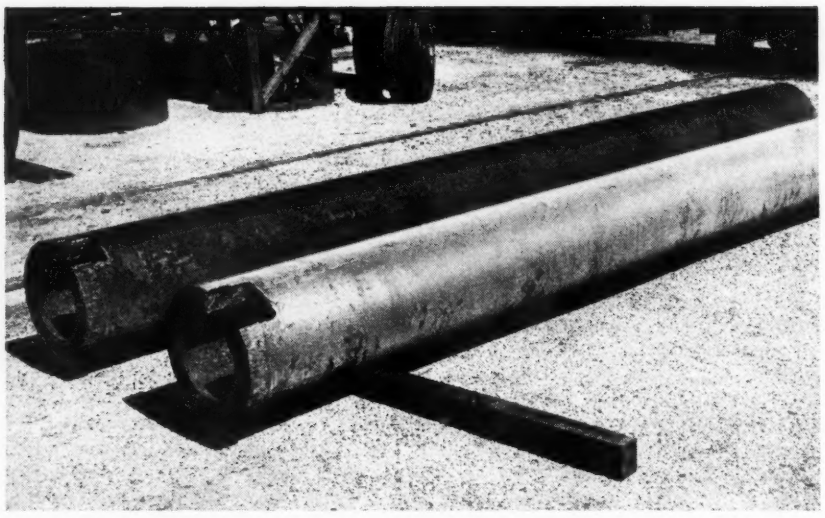


Fig. 1. Centrifugally Cast Tubes Employed in Making Carbon-steel Propeller Shaft. These Tubes are in the "As Cast" Condition. Plugs have been Removed from the Tubes for Use as Test Specimens

The molten metal is poured into the mold while the mold is spun about its own axis; the centrifugal force imparted by the revolving flask holds the molten metal against the wall of the mold until the metal solidifies. The inside diameter and the wall thickness of the tube are determined by the volume of metal poured. Pouring temperatures range from 2750 to 2950 degrees F.

Using the experience gained in the manufacture of cast-iron pipe, a favorable mold speed while pouring has been determined as one that will give a centrifugal force of about 75 pounds pressure per pound of metal. For thick-walled castings, it is necessary to select a compromise diameter on which calculations for spinning speeds can be based; otherwise, excessive forces will result at the outside diameter.

By "favorable" casting speed is meant one that will provide sufficient force to place and hold the molten metal on the mold wall and, at the same time, squeeze out such impurities as dirt, slag, sand, and gas pockets. Spinning speeds are critical in determining the soundness of tube castings. If the speed is too slow, the metal will not "pick up" on the mold wall, with resultant slipping or "raining" until the metal solidifies. This condition will cause laps and the entrapment of foreign inclusions. At the other extreme, excessive spinning speed may produce high hoop stress, or circumferential tension, causing longitudinal "hot tears."

After cooling, the tube castings are mechanically stripped from the mold, subjected to magnetic particle inspection, and annealed or normalized and tempered. The tubes then are shot-blasted on the outside, dry-ground on the inside, and machined if required.

The ability to secure long-length centrifugally cast steel tubes in a large range of diameters and to practically any analysis is of great economical value. For example, a designer requiring three tubes of different diameters and thicknesses made from an expensive alloy steel may secure as little as a 16-foot length of all of these from the same furnace charge. He would probably experience some difficulty in obtaining similar quantities of the desired alloy in the correct sizes from the high-production tube-rolling mills. In the high-alloy steels, the mills usually roll only the most popular alloys, such as, 18-8 or 25-12. These tubes must be confined to the most used diameters and thicknesses, as otherwise stocks would accumulate in slow moving sizes.

Many designers have taken advantage of the flexibility and economy of centrifugally cast steel

Fig. 2. Automatic Welding of Centrifugally Cast Carbon-steel Propeller Shafts

tubes. Even though many long-length tubes are employed for such uses as hydraulic cylinders, plungers, piston-rod sleeves, hollow shafting, and refinery-still tubes, a considerable number of 16-foot cast lengths are cut up into shorter lengths for such services as gear hubs, ring gears, hoist drums, safety-seat rings, bearing backs, pump cylinders, motor and generator frames, and many other uses. These can be made of any desired stainless, alloy, or carbon steel with equal facility. There is a broadening field for weldment applications, and designers would do well to enlighten themselves on the possibility of utilizing cast-steel tubes in composite structures.

It is evident that there are various applications in industry requiring heavy-wall tubing, and it is in this field that the producer of centrifugally cast steel tubes can render a real service. Such applications as shafts, rolls, retorts, etc., where quantities are not large, cannot, as a rule, be serviced by the steel-tube rolling mills. In many cases, heavy-wall tubes have supplanted forgings for shafts or machinery parts.

This fact was utilized in the design of the shafting for the Owasco Class coast guard cutters, which required a propeller shaft 44 feet in length, capable of absorbing the torque of a 4000-H.P. propulsion unit. Two centrifugally cast carbon-steel tubes were welded to solid forged couplings to make up the lineshaft; and one centrifugally cast tube was welded to a solid forged coupling on one end and to a solid tapered propeller mounting on the other end for the tailshaft. Two of the cast tubes are shown in Fig. 1.

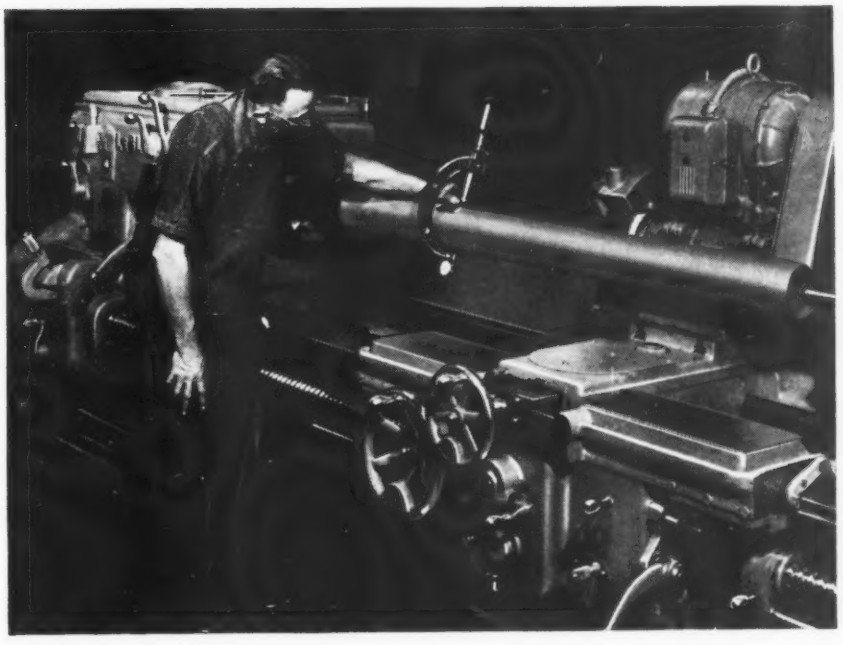
These units were unique in that it was necessary to develop a satisfactory procedure for welding the nickel-steel forgings to the cast-carbon shafting. The machined shaft components were first tack-welded in position and then placed in electrically driven welding jig rollers. Welding was done both manually and automatically, the latter method being shown in Fig. 2.

The 25 per cent chromium, 20 per cent nickel steel retort shown in the heading illustration is made from two castings, each 12 feet long and approximately 32 inches in diameter. This is a typical example of the special alloy-steel applications for which the process is especially suited.

* * *

Huge Bascule Bridge Supported by Roller Bearings

Twelve roller bearings of precision type have been provided on the world's largest bascule bridge to enable four 75-H.P. motors to lift the bridge sections, which weigh 8000 tons. This bridge has recently been built on North State St. in Chicago. The bearings which carry the heaviest load (1,535,000 pounds) are in a center truss trunnion and have a bore 25 1/2 inches in diameter. A feature of the installation is the self-aligning design of the bearings. Each bearing assembly can adjust itself during erection and upon any later change in the alignment of the vertical setting of the bearing housing. This feature is particularly valuable as, on a bascule bridge, the outer bearing for a trunnion is carried on solid masonry and the inner bearing on a long girder that is subject to deflection.



The Special-purpose Grinding Lathe Here Shown was Recently Developed by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, to Grind Rubber Printing-press Rolls at the Springfield, Ohio, Plant of the Crowell-Collier Publishing Co. This New Machine has a Center Distance of 120 Inches, and a Swing of 27 1/2 Inches over the Ways and 13 Inches over the Slide. It is Equipped with a 5-H.P. Grinding Unit Mounted on a Special Carriage and Slide. The Rolls are Suspended between Centers by Two Steel-body Chucks, One on the Headstock and One on the Tailstock Spindle. A Special Revolving Spindle Tailstock is Used to Facilitate Rotation of the Tailstock Chuck

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Carburizing Steels Developed for Heavy-Duty Gears and Shafts

A series of four improved carburizing steels are being produced under the name U.S.S. "SuperKore" by the Carnegie-Illinois Steel Corporation, Pittsburgh 30, Pa., to meet the need for deep-hardening steels that can be easily machined into gears, shafts, and pinions for airplanes, trucks, buses, and other equipment subject to heavy-duty service. These new steels are designed to reduce both material and manufacturing costs.

"SuperKore" steels have a hardenability equal to or greater than the more highly alloyed grades in common use, and also maintain the high core strength and develop the toughness necessary for heavy-duty applications. In addition, these new steels have improved carburizing characteristics, are easier to anneal, and possess substantially improved machinability. 201

Berylco 165 Alloy—A Spring Material with Lower Beryllium Content

A beryllium alloy with lower beryllium content, known as "Berylco 165," which meets all performance requirements of the A S T M Specification B 194-46T, has been introduced by the Beryllium Corporation, Reading, Pa. The lower beryllium content gives greatly increased tool life and makes the alloy available at substantial cost savings.

This alloy is produced in a heat-treatable form and also in a mill-hardened form. The mill-hardened alloy (Berylco 165ST) requires no heat-treatment. It has sufficient ductility to withstand extreme forming operations, and yet has high strength. Strip 1 No. hard, for example, develops over 100,000 pounds per square inch tensile strength, and yet can be bent through 180 degrees without fracture. This alloy is particularly suited for small high-production parts, such as separable connectors, eyelets, tube socket contacts, rivets, and cold-headed parts.

The heat-treatable alloy (Berylco 165S) can be used for any stamped, drawn, formed, or blanked part calling for A S T M grade material, such as flat springs, contact blades, formed parts, and electrical connectors. It is adaptable for fixture hardening or bulk hardening, and for short-time high-temperature hardening cycles. 202

Silicone Oils Developed for Special Applications

Several new silicone oils have been developed by the Dow Corning Corporation, Midland, Mich., for special applications. One of these—DC 710—is adapted especially for high-temperature lubrication, being suitable for use over a temperature range of from 10 degrees F. to 500 degrees F. (—12 degrees C. to 260 degrees C.). A variation of this silicone oil, DC 710G, provides excellent lubrication and protection for mechanisms continually exposed to heat, high humidity, or to the atmosphere. Another variation—DC 710R—permanently lubricates such sealed-in precision devices as clocks and instruments. The DC 710 oils can also be used as high-temperature bath liquids and as high-temperature hydraulic fluids.

The following properties account for the usefulness of these oils: (1) Heat stability to 500 degrees F.; (2) resistance to oxidation; (3) freedom from gumming; (4) low volatility; (5) water repellency; and (6) good lubricity at medium to light loadings. 203

Graphite-Bearing High-Carbon Alloy Steel

A high-carbon alloy steel containing free graphite (known as 91140) has been developed by the Timken Roller Bearing Co., Steel and Tube Division, Canton 6, Ohio. This steel is said to be particularly suitable for bed ways and other machine tool parts, as the presence of free graphite, together with carbides, gives high resistance to wear and freedom from scoring.

In addition to its application for bed ways, it has been used for such parts as grinding-wheel spindles, pump shafts and pistons, cams, change-gears, chucking fixtures, clamps, collet fingers, ratchets, and universal ball joints. 204

Cast-Iron Flux Applied in Paste Form for Gas Welding

A cast-iron flux in paste form for gas welding, which is said to be more economical and easier to use than a powdered type flux, has been placed on the market by All-State Welding Alloys Co., Inc., White Plains, N. Y. Unlike powdered flux, which is applied by dipping the heated end of the rod into the can, this paste flux, known as "All-State No. 1A," is painted on the clean surface of the iron while the casting is still cold. The cast-iron welding rod may also be painted with the flux in order to provide additional flux as the work progresses. This flux is used in the repair of broken castings, salvage of defective castings, repair of pitted cast-iron molds, and correction of machine shop errors. 205

New Acme Liquid Polishing Composition

The Hanson-Van Winkle-Munning Co., Matawan, N. J., has developed a new liquid composition for polishing nickel, brass, copper, aluminum, and zinc die-castings. The product, known as "Acme Grade 4-L-10," is easily cleaned from the work, leaves the face of the buff soft and clear, and does not clog fluid lines. It is recommended for use with pressure type composition spray equipment. 206

Fast Drying Finish Gives Good Corrosion Protection

A new co-polymer finish, designated P-5, consists of a series of coatings designed to be applied to metal, wood, and concrete for protecting such materials from the corrosive action of moisture, acids, alkalies, and many other disintegrating elements. These coatings were developed for industrial use, and have been placed on the market by Industrial P-5 Division, the Watson-Standard Co., Pittsburgh 12, Pa.

In addition to its chemical resistance, the new finish is free from objectionable odors, is non-toxic, and dries by evaporation without requiring an oxidation period. It has good thermal stability, is highly resistant to abrasion and scrubbing, has good aging characteristics, and does not oxidize or become brittle. 207

Optimus Detergents Co. Announces New Cleaner for Aluminum

A new metal cleaning compound especially designed for cleaning aluminum, designated Optimus No. 101A, has been announced recently by Optimus Detergents Co., Matawan, N. J.

The new product is a medium-duty alkaline cleaner that includes special water softening materials and inhibitors to prevent attack on the metal. It is particularly effective for removing dirt, grease, and oil. Optimus No. 101A can also be used as a soak cleaner for non-ferrous metals other than aluminum, such as zinc, brass, bronze, pewter, etc. In this application, the work can be made the cathode and cleaned electrically. With aluminum, the electro-cleaning application does not apply. 208

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in JANUARY, 1948, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

Simonds Introduces Novel Sales Training Program

As a means of educating sales personnel and distributors on all the varied applications of saws, files, and other metal-cutting tools, the Simonds Saw & Steel Co., Fitchburg, Mass., recently developed a series of models of typical wood- and metal-working machines to which their products can be applied. These models, which are accurately scaled to size and are so designed that the miniature cutting tools mounted on them are movable, will be used to supplement motion pictures and catalogue literature in a comprehensive training program that will be offered to distributors over the next two years. The exhibit will be kept in a room which the company calls "The Little Red Schoolhouse."

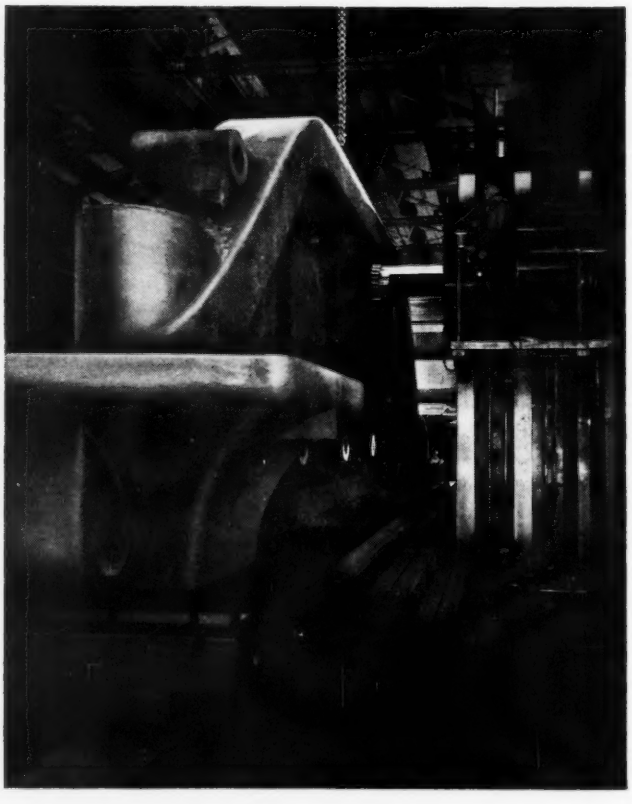
Included in the exhibit of metal-cutting equipment is a circular saw for cutting steel bars and shapes, a metal shear, horizontal and vertical band-sawing machines, power hacksaws, and a cut-off saw. It is felt that this exhibit will not only prove of value by providing background information on which the sales engineer and distributor can build, but will also give the workmen in the factory a greater interest in their jobs, since only a small percentage of the employes have ever seen the products that they make in operation or have even seen the types of machines on which they are used.

Allis-Chalmers Celebrates One-Hundredth Anniversary

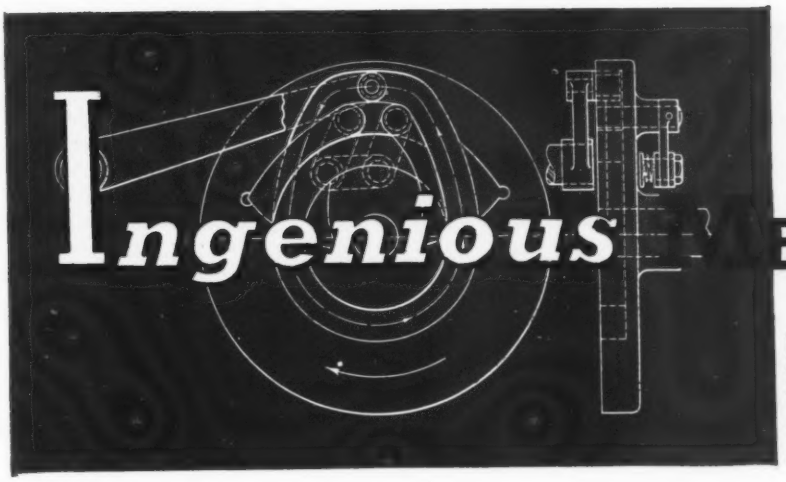
Allis-Chalmers Mfg. Co., Milwaukee, Wis., is celebrating this year the completion of one hundred years of manufacturing and engineering achievement. The company was started by Edward P. Allis in 1847. In 1901 the Edward P. Allis Co. was merged with the Fraser & Chalmers Co., and the Gates Iron Works of Chicago, and the Dickson Mfg. Co., of Scranton, to form the Allis-Chalmers Co. Under a policy of producing diversified equipment, the company's activities have extended until it now manufactures more than 1600 products, primarily in the power generation, power distribution, and power utilization field, for the metal and machine industries. One of the outstanding developments of the company was the Texrope V-belt drive, originated in 1924 by Walter Geist, who became president in 1942.

* * *

Far too many people are demanding an ever increasing standard of living—more of the necessities and more of the luxuries of life—without realizing that the burden of producing these things falls squarely on their own shoulders.—*L. E. Osborne, Senior Operating Vice-president, Westinghouse Electric Corporation*



Large Ingersoll Table Type Open-side Milling Machine being Employed for Boring and Facing the Tie-rod Holes in a Press Bed Weighing 144,000 Pounds. This Milling Machine is One of the Modern Machine Tools being Installed by the E. W. Bliss Co. in Its Salem, Ohio, Plant under a Current Expansion Program



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Vise Operated by a Rack and Pinion with Locking Motion

By L. KASPER

A rack and pinion that locks when it encounters resistance to motion, but that is free to operate when the resistance is removed or when its motion is reversed can be used in a variety of shop mechanisms. For example, it can be applied on a vise, as shown in the accompanying illustrations, when a rapid change of opening is desirable and positive locking in any position is necessary.

As shown in the plan and front elevation views of the vise, Fig. 1, part *A* is grooved to carry rack *B*, to which the movable jaw *C* is attached. Pinion *D* fits in a recess in block *E*, and is keyed to shaft *F*, as is handle *G*. Block *E* is free to slide in a recess in the base; this recess and the contacting edge of the block are machined at an angle to the pitch line of the rack. Spring *H*, which is in compression, exerts pressure against the block and holds it against the right-hand wall of the recess with a force sufficient to overcome the frictional resistance of the rack to movement. Plate *J*, shown in the front elevation view, serves as a retainer for the assembly.

In operation, as handle *G* is turned in the direction of the arrow, the rotation of the pinion causes the rack to move to the right. This movement continues until jaw *C* comes in contact with the work-piece *W*, when further movement is prevented. Continued turning of the handle causes block *E* to be moved to the left by the

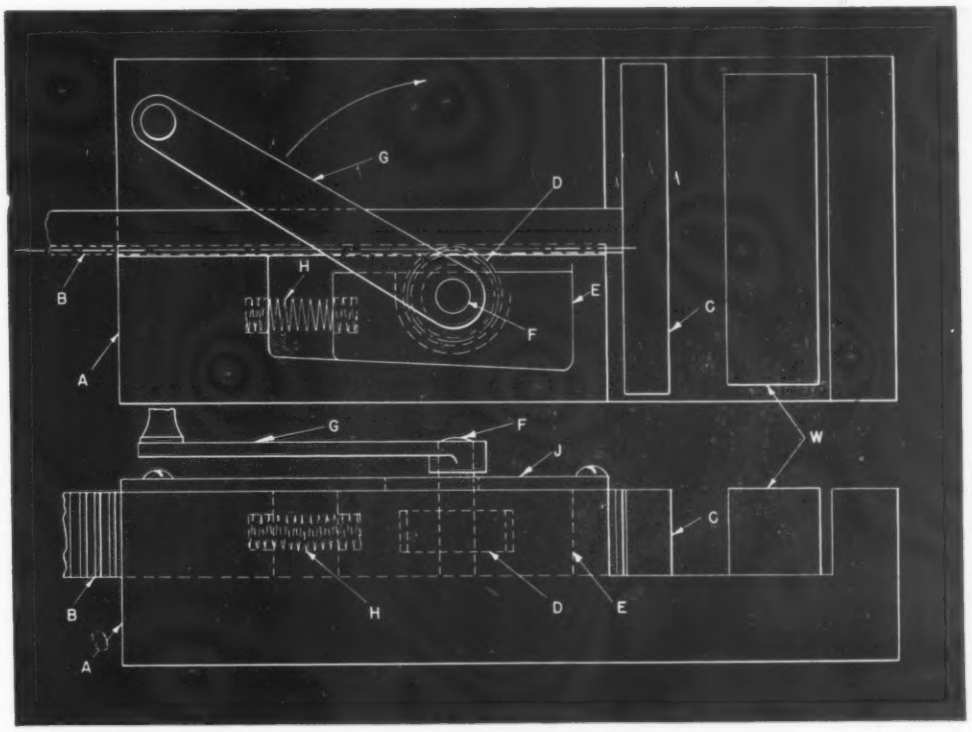


Fig. 1. Vise Equipped with a Rack and Pinion that is Designed to Permit Rapid Clamping and Positive Locking in Any Position. The Force Exerted by Spring H is Sufficient to Hold Block E against the Right-hand Wall of the Recess until the Movable Jaw C Comes in Contact with the Work

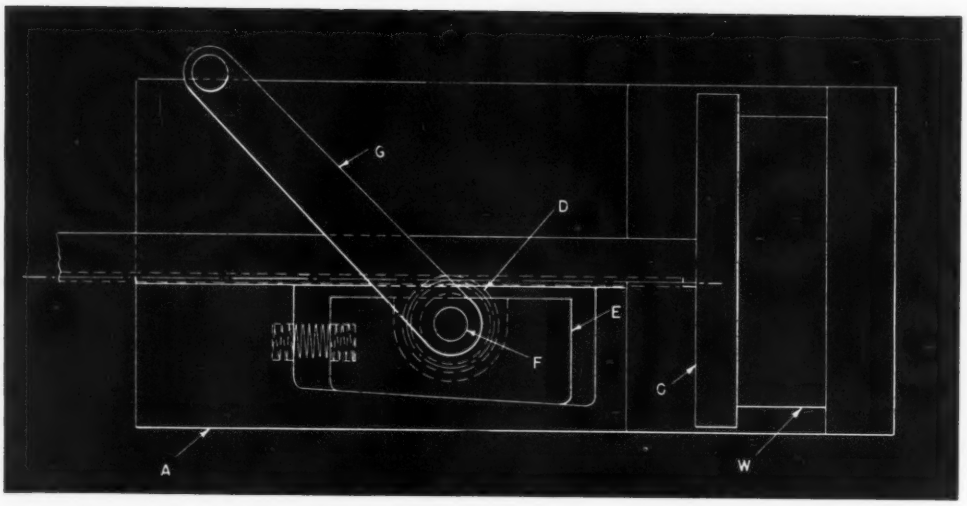


Fig. 2. When Jaw C Comes in Contact with the Work, Rotation of Lever G Wedges Block E between the Rack and the Wall of the Recess, thus Locking the Work in Place. Counter-clockwise Rotation of the Lever Frees the Block and Releases the Jaw

force exerted by the pinion. Owing to the wedging action of the block, the rack is firmly locked against any reverse movement. However, when handle *G* is turned in a counter-clockwise direction, the block returns to its original position and the rack is freed for releasing the work.

* * *

Determining the Face Width of Spline Cutters

By HERMAN A. NEFF

Occasionally, because of a rush job in the shop, it is necessary to grind plain milling cutters for cutting splines and broaches rather than wait to procure cutters designed for this purpose. In such a case, the milling cutter should be chosen with a face width slightly greater than the width between adjacent splines.

In the accompanying illustration, the dimensions can be defined as follows:

A = angle between center line of spline and a radial line passing through intersection of root circle and one side of spline;

a = angle between center line of spline and a radial line passing through the intersection of the major circle and one side of the spline;

C = chordal width at root circle between adjacent splines, or width of concave edge of cutter;

C' = chordal width at major circle between adjacent splines or minimum width of spline cutter;

D = major diameter of spline shaft;

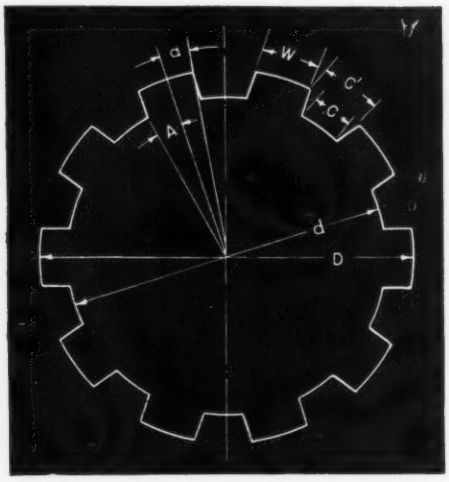


Diagram Indicating Critical Dimensions of a Spline Cutter

d = minor diameter at root circle;

N = number of splines; and

W = width of spline (available from standard handbooks).

Then, the solution for the desired face width of the cutter can be calculated by expanding the formula for the width of the concave edge.

$$\text{Sin } a = \frac{W}{D}$$

$$C' = \sin\left(\frac{180}{N} - a\right) \times D$$

Once this dimension is obtained, a cutter with a slightly larger face width can be specified and ground to size.

* * *

Grinding burn can be detected in hardened steel by suitable etching of the ground surface even when all traces of discoloration have been cleaned off. Norton engineers have developed a procedure that involves etching for fifteen seconds at room temperature in a 4 per cent solution (by volume) of concentrated nitric acid in water, followed by etching for the same time in a 2 per cent solution of concentrated hydrochloric acid in acetone. This etching causes areas rehardened by excessive heat in grinding to appear nearly white, while softened areas resulting from a smaller temperature rise turn dark gray or black. Areas unaffected by the grinding are a light gray.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Adapting a Lathe for Turning Special Dowel-Pins

By DONALD A. BAKER, Boonton, N. J.

A light-duty lathe equipped with a hand-fed turret and a screw-fed type of turret lathe cross-slide was adapted, as described in the following, for machining special dowel-pins such as shown at *D* in Fig. 1. Twenty thousand of these pins were machined to finished size and cut off from bar stock by means of this set-up at the rate of 120 per hour.

The feed-nut of the cross-slide screw was removed so that the slide could be fed transversely by templet *T* to turn the work to the desired shape, and by hand-lever *N* to cut off the finished part and point the next part.

Carbide-tipped tools were used for turning and chamfering the pin. The taper on the nose of the pin was rough-turned by the back tool *B*, mounted on the cut-off tool-block *L*, and the front tool *F*. Tool *A* was used to finish-turn the taper, turn the outside diameter of the body, and produce the 45-degree chamfer at the large end of the pin. The corner on the small end was turned by radius tool *R*. The finished pin was cut from the bar stock by blade *M*.

Templet *T* is a hardened and ground piece of 3/16-inch thick stock having the exact outline of the required part on its front edge. It was screwed and doweled to bar *J*, which was secured to the lathe bed by clamps *C*. Bar *J* is slotted at *E* to permit adjusting the templet to make it parallel with the work.

A hardened and polished pin *P*, which follows

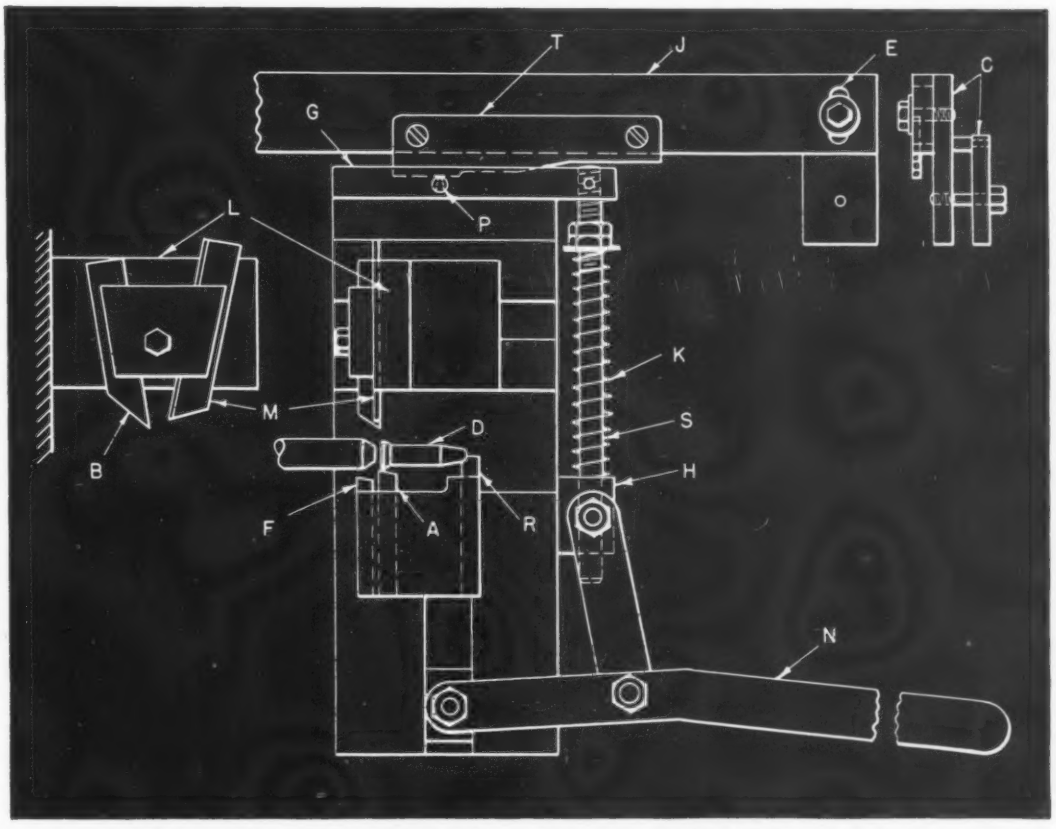


Fig. 1. Set up for Finish-turning and Cutting off Special Dowel-pin D on a Lathe. The Front Edge of Templet T has the Same Contour as the Pin

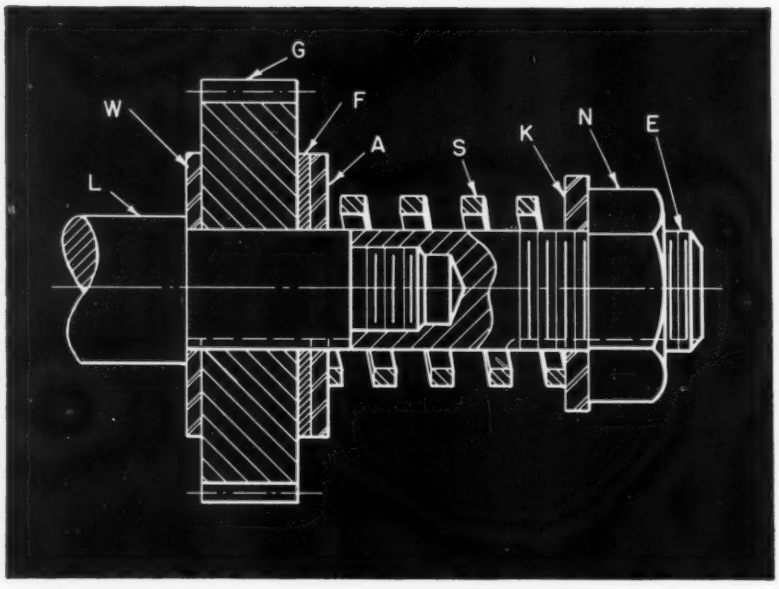


Fig. 2. Friction Drive Attachment for the Lathe Lead-screw, which Permits Change-gear G to be Rotated while the Lead-screw L Remains Stationary when the Carriage Comes in Contact with a Stop

the contour of the templet and controls the transverse feed of the forming tools, was driven into a steel bar *G*, mounted on the back end of the cross-slide. Shaft *S* was threaded and pinned to the right-hand end of this bar. This shaft is free to slide transversely in block *H*, which is mounted on the side of the lathe carriage. Coil spring *K* on shaft *S*, keeps pin *P* in firm contact with the contour edge of the templet.

In operation, the work is fed against a turret stop (not shown). The carriage feed is then engaged and the carriage advances until it strikes a solid stop attached to the lathe bed at the left of the carriage. Next, hand-lever *N* is pulled forward, cutting off the finished pin and pointing the end of the next piece. In order to prevent damage to the gears or other parts of the lathe in case the operator should forget to disengage the split-nut from the feed-screw when the carriage comes in contact with the stop, a lead-screw friction drive was designed, as shown in Fig. 2.

Gear *G* was removed from the outer end of lead-screw *L* at the headstock end of the lathe, and a hardened washer *W* was placed against a shoulder machined on the lead-screw, and keyed to the screw. The gear was replaced without its key, thus leaving it free to rotate about the lead-screw. A fiber washer *F* was inserted between a second hardened washer *A* and the gear. Washer *A* was also keyed to the lead-screw.

An extension *E* was screwed to the outer end of the lead-screw. Then a heavy, square-section coil spring *S* was mounted over the extension and held in place by a keyed washer *K* and nut *N*. With this arrangement, it was only necessary to tighten the nut to produce sufficient friction between gear *G* and washer *W*, and between fiber disk *F* and washer *A*, to drive the lead-screw. When the carriage came in contact with the stop, slippage occurred between these members, thus permitting the gear to turn and the lead-screw to remain stationary without damaging any part of the lathe.

Bending a Textile Mill Forging in an Arbor Press

By ROBERT MAWSON, Providence, R. I.

Some of the tool manufacturing methods employed by textile machinery companies are unique. One interesting operation is the hot-forming of a drawing frame flyer, which is part of a textile drawing frame and is used to guide the yarn onto a bobbin.

The flyer is made from a steel forging *X*, such as is shown in Fig. 1. The first sequence of operations consists of turning down the long ends to the proper taper, drilling and reaming a 1/2-inch hole through the center boss, and buff-polishing the entire length of the two tapered ends.

Next, the forging is bent to shape, as shown in *Y*. This operation is performed on a hand-operated arbor press, using the tool shown in Fig. 2. The tool is made with a machined shank *A* to fit the ram of the press. On the table of the press is fastened a plate in which there is a locating pin *B* that fits the reamed hole in the flyer forging. The yoke of that portion of the tool which is fastened in the press ram is equipped with two concave rollers *C* that are carried in brackets fastened to the sides of the yoke by pins. Owing to the fact that steels of various analyses have a different "set," the roller

brackets and locating plates *D* are provided with adjustments to correct these variations.

To perform the bending operation, the forging is placed in an open forge fire and heated to a temperature suitable for bending. It is then placed on the locating pin *B*, and when the operator pulls down the ram of the press, the rollers *C* come in contact with the forging. Upon further downward movement, the flyer forging is forced down and in against the locating plates until it has a shape similar to that indicated at *E*. The final operation is now performed, which consists of bending one of the ends of the forging by hand to make a pig's tail; this bent shape is known to the trade as a "twizzle." Drawing frame flyers are made in different lengths, from 6 to 10 inches, the required length being produced by cutting off the proper amount from the ends of the formed forging.

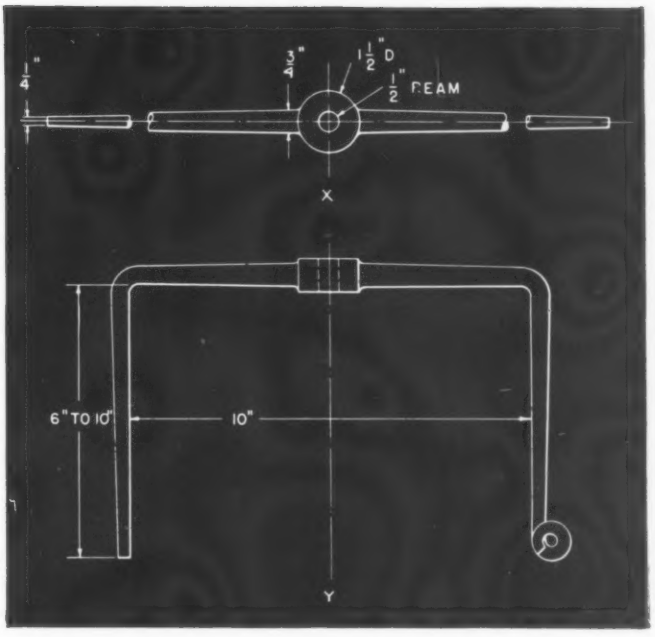


Fig. 1. (X) The Steel Forging before being Bent into Shape; (Y) The Completed Drawing Frame Flyer

* * *

Steel Production the Greatest of Any Peacetime Year

More steel was produced by the American steel industry in 1947 than in any previous peacetime year, the total production being over 84,000,000 tons. This production was exceeded only in the war years of 1942, 1943, and 1944. A higher output in 1948 depends on a sufficient supply of raw materials and freedom from strikes.

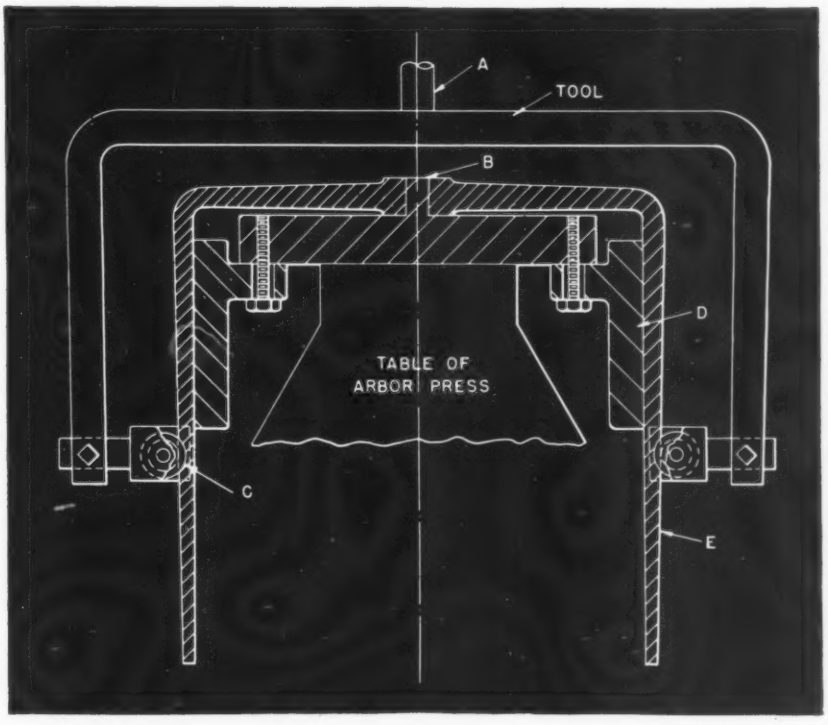


Fig. 2. Details of the Arbor Press and Bending Tool

Electrical Engineers' Meeting to Feature Machine Tools

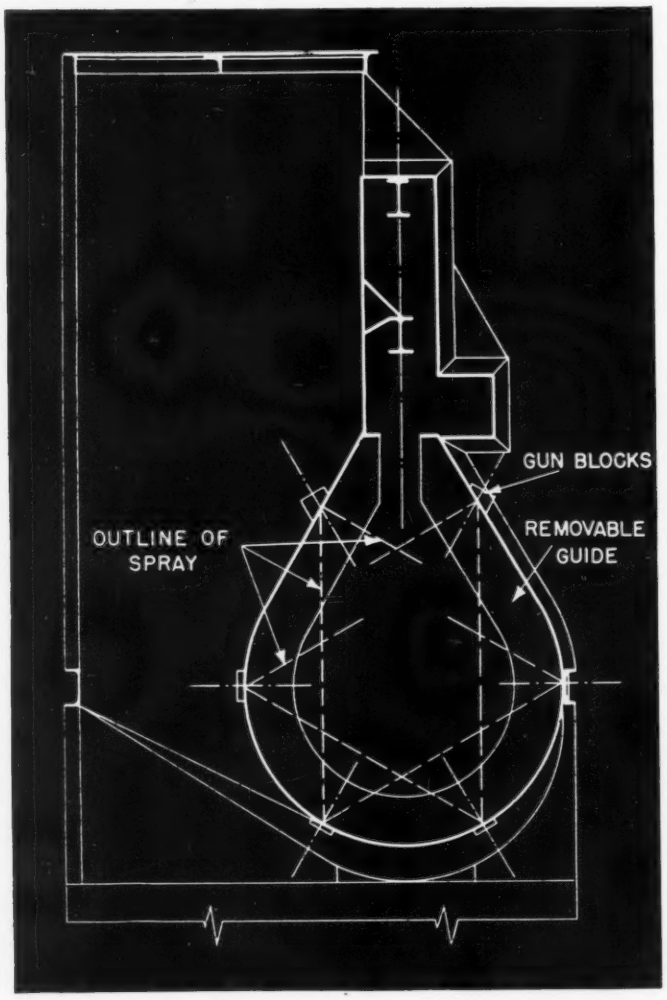
The winter meeting of the American Institute of Electrical Engineers, to be held January 26 to 30 in Pittsburgh, Pa., will include a full conference session on the electrical engineering aspects of machine tools. At this session, which will take place on January 27, the following papers will be presented: "Electrical Engineering in Machine Tool Industry," by W. B. Wigton, Cincinnati Planer Co.; "Electric Drives for Planers," by J. W. Harper, Industrial Engineering Division, General Electric Co.; "New Types of Adjustable-Speed Motors for Machine Tools," by W. M. Elder, Westinghouse Electric Corporation; and "Electrical Features and Performance Analysis of an Automatic Hob and Relief Cutter Sharpener," by R. E. Johnson and Frank A. Glassow, Barber-Colman Co.

* * *

In 1946, the average annual earnings of railroad employes amounted to $3068.92. This average exceeded the 1939 level by $1182.33, and was higher than the 1945 level by approximately $350.

Automatic Spray Booth with Two Separate Paint Circulating Systems

COMPACTNESS, cleanliness, elimination of handling, and a saving in labor are advantages obtained by the use of a dry type, automatic paint spray booth employed in painting axle assemblies at the Chevrolet Gear & Axle Division of the General Motors Corporation. Developed during the war, this booth permitted immediate transfer from the coating of commercial axles with acid-resisting black paint to the spraying of military axles with a red oxide paint. Two paint circulating systems permit two colors of paint, or primary and finish coats, to be applied with the same set-up. At present, one system is being used as a standby in case of failure of the other. This arrangement facilitates cleaning of the paint spray guns in one system without interrupting production.



End View of an Automatic Paint Spray Booth Used in Spraying Automotive Axle Assemblies, which are Carried through the Booth on Conveyors

Dipping of automotive axle assemblies in paint is impracticable, due to danger of the paint getting between the brake rim and housing and onto the brake lining. Manually operated spray guns would require the use of elaborate water-wash spray booths to protect the painters from fumes.

The two paint circulating systems are located at each end of the booth. Each system contains twelve Binks air-operated paint spray guns, distributed radially around the opening in the booth through which the axle assemblies pass to conveyors. The end view of the booth shown in the accompanying illustration indicates the arrangement of the blocks in which the paint spray guns are mounted and the outline of spray from the guns, which collectively cover the complete axle assemblies.

Each spray gun is connected to three manifolds—one feeding high-pressure air at 50 to 60 pounds per square inch from the factory air line; another feeding low-pressure air at 13 to 15 pounds per square inch from an 8 cubic foot air supply tank; and the third feeding paint, which is pumped from one of the two paint supply tanks located at the ends of the booth.

Both high- and low-pressure air are passed through separators to remove moisture and through regulators to adjust the pressure. The low-pressure air tank is supplied from the factory air line after the air has passed through the pressure regulator. The high-pressure air passes through an oiler, which adds lubricant for the paint spray guns.

Rotary pumps having a capacity of 35 gallons per minute and driven at 400 R.P.M. by 2-H.P. motors transfer the paint from the supply tank through the manifold to the guns. A spare pump is provided for each paint circulating system to prevent interruptions in production.

The high-pressure air, which is used as the control medium for the paint spray guns, actuates the valves in the guns that permit the low-pressure air to mix with and atomize the paint. The high-pressure air supply to the gun valves is turned on and off by solenoid-operated air valves. These valves are connected to limit switches that are actuated by hooks on the conveyor that carries the axles through the booth.

The spray booth is a continuous welded assembly of 14-gage sheet steel and angle-irons, having a length of 12 feet 6 inches, a height of 6 feet 4 inches, and a width of 5 feet 3 inches.

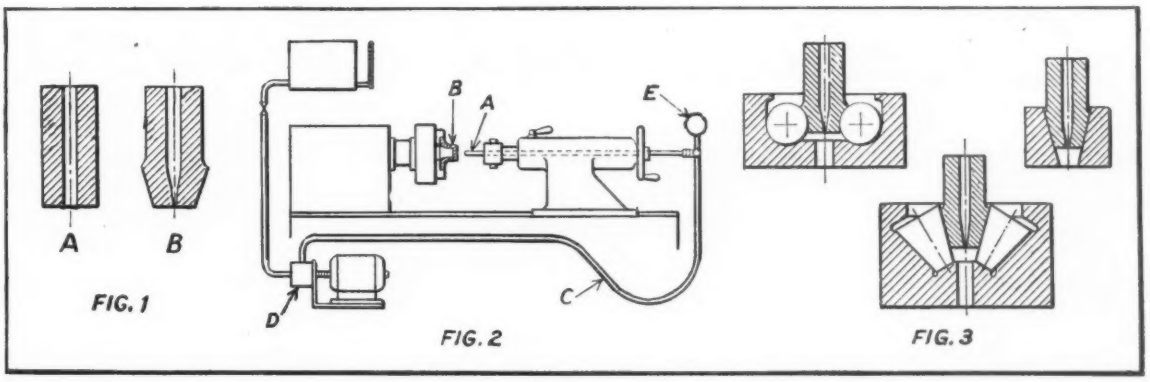


Fig. 1. The Nozzle before and after Rolling. Fig. 2. Diagram of Lathe and Calibrating Pressure System. Fig. 3. Types of Spinning Tools for Rolling Nozzles

Paint is carried in 1 1/2-inch diameter standard pipe, low-pressure air in 1-inch diameter pipe, and high-pressure air in 1/2-inch diameter pipe. Piping for the manifold is bent to shape and welded to the inner shell of the spray booth.

Clean, stringy, metal chips from various machine tools are placed in angle-iron frames and used in the exhaust stack of the paint spray booth. Such an arrangement makes an effective filter and prevents the paint from being exhausted through the stack and deposited on the roof. The chips have to be replaced approximately every six months, but their scrap value is unchanged after use.

* * *

A.S.M.E. Honors C. E. Lucke

The idea of organizing an engineering society into units or professional divisions of the parent group was originated forty years ago in the mind of Charles Edward Lucke, who saw his own society threatened because of the diverse interests of its members. His plan of "societies within a society" formed the framework of the American Society of Mechanical Engineers, which today has grown to 24,000 members having nineteen professional divisions, each of these divisions operating in a special branch of engineering.

The initiator of this plan is now professor emeritus of mechanical engineering at Columbia University. Because of his achievement, the American Society of Mechanical Engineers, during its recent annual meeting at Atlantic City, presented Dr. Lucke with a scroll suitably inscribed.

* * *

The average freight train load in 1946 was 1086 tons, an increase of 66.8 per cent compared with 1921, when the average was 651 tons.

Lathe Adapted to Produce Calibrated Fuel-Injection Nozzles

The production of nozzles having small internal diameters has been facilitated by a method whereby calibration is carried out during the machining operation. By this method, the lathe operator who rolls the nozzle into final shape has a constant check on its pressure characteristics, and hence on its injection rate.

The nozzles, ranging in diameter from 0.0004 to 0.004 inch, are first drilled to a diameter somewhat larger than required, as at *A* in Fig. 1, and are then rolled to the desired diameter, producing the shape shown at *B*. During the operation, fluid is supplied at high pressure through the nozzle, and the operation is interrupted—either manually or by electrical contacts—when the pressure shows the desired value.

Fig. 2 shows the general arrangement of the lathe and pressure system. The drilled nozzle *A* is held in the tailstock, and the rolling tool *B* is chucked in the headstock. Either the nozzle or the tool may be rotated; the latter has an advantage in that it simplifies the supply of the calibrating fluid. For mass production, tube material is fed through the tailstock and cut off in the machine.

The pressure fluid, which is supplied from an overhead tank, is forced through the flexible pipe *C* by the pump *D*. A gage at *E* gives a constant check on the back pressure of the nozzle.

The graduating fluid is supplied to a small cylinder fixed to the tailstock. The piston of this cylinder is operated by the feed-screw of the lathe and feeds the pressure fluid. This arrangement insures that the amount of fluid forced through the nozzle in a given interval of time remains constant.

In Fig. 3 are shown types of squeezing or spinning tools, which may incorporate steel balls or conical rollers, or may consist of a conical die.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Skive Tool Material for Sizing Stainless-Steel Parts

B. E.—What type of material is best suited for skive tools to be used for sizing Type 302 stainless-steel parts on an automatic turret lathe, and what are the recommended cutting feeds, speeds, and tool angles?

A.—For sizing Type 302 stainless-steel parts, high-speed cobalt-steel, cast-alloy, or carbide-tipped tools may be used; the latter, in general, provide the best finish. From 0.005 to 0.010 inch of metal may be removed per stroke. The feed and speed naturally depend on the degree of finish required and on the strength of the part. A feed per revolution of from 0.0005 to 0.001 inch, and a cutting speed—using a cast alloy—of from 80 to 110 surface feet per minute probably would be satisfactory. For high-speed steel tools, the cutting speed would be 15 to 25 per cent lower, and for carbide-tipped tools, proportionally higher.

The tools may be designed with either a flat or a dovetailed surface, a shear angle of from 5 to 15 degrees, a front rake of 10 to 15 degrees, and a clearance angle of 1 to 2 degrees. These conditions are governed by the finish required and the size of the work.

Can a Sales Manager Make a Valid Contract for a Corporation?

P. F.—Can a sales manager make a valid contract for a corporation? If so, can he also cancel a valid contract?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

No corporation employe, including a sales manager, may make a valid contract or cancel a previously made contract without proper authority. As a case in point, see Williams [14 So. (2d) 319]. Here it was disclosed that a company filed suit against a purchaser for $1012. The testimony proved that a contract was signed by the president of the company. The purchaser then testified that he was relieved of responsibility because the sales manager had agreed to release him from all obligations under the contract.

However, the higher court held the purchaser fully liable under the contract and said: "There was no evidence upon which to predicate the fact that Gimbert (sales manager) either had the authority to release the defendant (purchaser) or that, as a matter of fact, he ever intended to do so."

It is possible for a purchaser to win a suit of this nature if he proves that in the past it was customary for the corporation's president or the directors to approve all agreements made by the sales manager. This testimony will convince the court that the sales manager was the corporation's "general agent," and fully authorized to make contracts for the corporation.

* * *

Who Knows About This Steel?

The following letter was received by the Editor of MACHINERY:

About twenty-five years ago, a brand of cutting steel known as "Lemoyne Supreme" was on the market, but apparently has since disappeared. If any of the readers of MACHINERY know who made this steel or have any information concerning it, I would appreciate hearing from them. I do not know whether it was a high-speed vanadium or cobalt type steel.

433 Fabyan Place — F. G. EBERHARDT
Irvington 11, N. J.

* * *

A detector weighing only one ounce, which can be set to operate a fire-alarm system at a predetermined temperature, is one of the newest safety devices developed for aircraft service. This device, which was designed by Control Products, Inc., Harrison, N. J., actuates the alarm within five seconds when exposed to a direct flame of 2000 degrees F., and indicates equally fast that the fire has been extinguished. The number of moving parts is kept at a minimum, and all moving elements, including the contact points, are hermetically sealed for protection against dirt and corrosive atmospheres. The design is such that false alarms cannot develop as the result of vibration.

How to Find Potential Business

By BERNARD LESTER
Assistant Industrial Sales Manager
Westinghouse Electric Corporation

EVERY successful factory worker knows his shop. He knows the machines and tools he operates, and the materials he works on. His job is usually laid out in advance.

But does the average salesman of machine tools or other shop equipment know his territory and customers? Don't too many of us wait for the inquiry, or go where we *guess* business is, and see those persons we know and like best?

The sales engineer generally sets up his own work. He decides where to go and whom to see. His work is always selective, picking out what is most important to do. Hence it is very important that he know his territory—the customers, plants, and key people who affect future business. He cannot work efficiently on hunches or scattered information—the more he knows of companies, plants, and key people, the greater the likelihood of a successful sales career. Facts give direction to sales effort.

Companies in a given territory, new and old, should be spotted and recorded by the sales engineer. The aim should be to list every company or plant whose manufacturing processes might require the equipment the salesman sells. With the advent of new materials, lots of machines are used on other than metal products. One machine tool builder does a large business in plants finishing glass and plastic products.

Every efficient sales engineer will have good maps of his territory on which are marked the location of customers and potential customers. Such maps save a great deal of time in making calls. They avoid doubling back, and help make every trip count.

The sales engineer must understand that some big plants are not good customer prospects. Their future operations may be downhill—with expansion and rehabilitation out of the question. On the other hand, some small plants are growing—are on the up grade and have plans for expansion. A dollar's worth of business from one such small plant may be several times as valuable as a dollar's worth of business from a much larger factory that is not likely to have any further expansion.

It should be borne in mind that companies, in the last analysis, never buy. Every inquiry, every specification, and every order originates from a person. So it is mighty important to know whom to see and whom to work with. Who has the final say? It may be an officer of the company, the purchasing agent, the superintendent, the foreman, or the plant engineer. Titles mean little. Some individual, perhaps not prominent on the personnel chart, may have more influence than anyone else as far as the particular sales engineer is concerned.

Where Can the Machine Tool Salesman Get Market Information?

Bankers are good people to know because money precedes machine and tool purchases. City officials in smaller centers can help because they are usually industrial-minded. Cultivate sales engineers handling other lines than yours. They call on the same people as you do. Their equipment may be required in advance of yours.

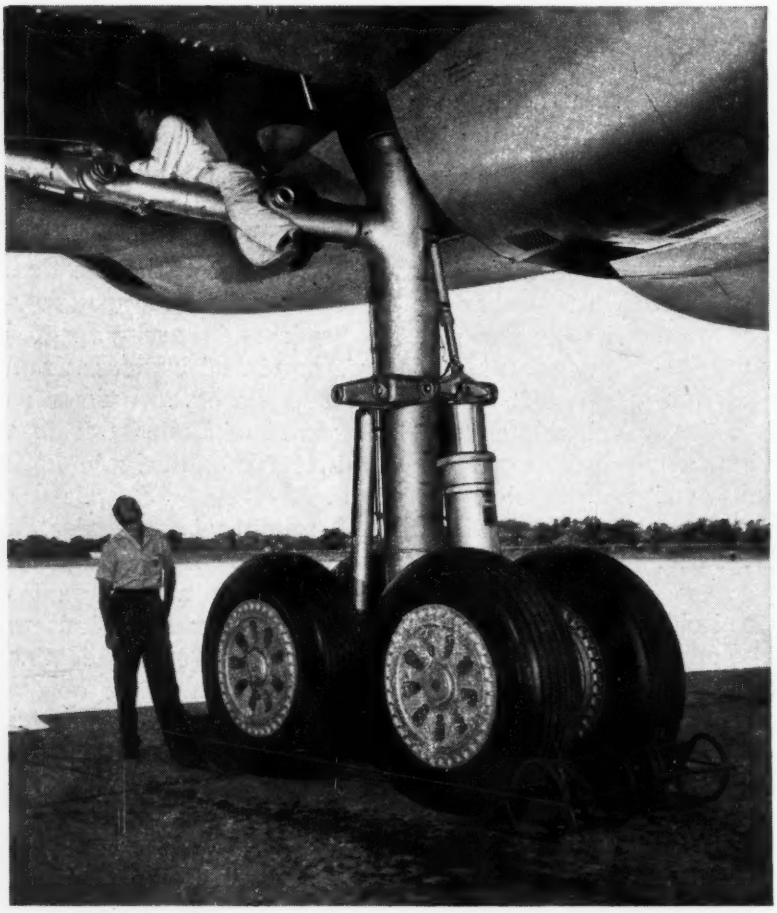
Read the technical journals of your industry. They have a nose for future undertakings. Sometimes trade directories and financial statements can supply desired facts.

There never was a consistently successful salesman of machine tools or small tools who did not get into plants and spend time in a study of the manufacturing processes, applying friendship, tact, and, above all, a basketful of information. Oil refineries have always been difficult to get into. I asked an outstanding sales engineer who handled oil-refinery equipment, "How do you manage to get into a refinery?" His answer was, "My problem is to get out." Obviously he was welcome because he brought something of value to the men who operated the refinery. That was one reason he got so many orders.

One big job is to find out "who's who" in a plant and concentrate on those individuals. A complete selling job cannot be done without reaching every person who has a say on buying the equipment under consideration, and also those men who decide whether the investment should be made. By making one friend in a plant, valuable information can be obtained regarding other important men in the same plant. We always gravitate toward established friends, but the successful sales engineer seeks new faces and makes new friends. One successful salesman said, "I always see my old friends, but if I don't make a new one during the week I feel that I have not done my job."

The successful salesman does not usually establish elaborate record systems in his office. But he should maintain a simple set of facts concerning each company and each plant, and keep it up to date. Briefly, a record of this kind should include such essential facts as the name of the company, its address, products turned out, processes employed, new projects, and, especially, accurate information about the plant personnel.

These are all elementary ideas, but if followed to the fullest extent, there would be fewer "Lost Business" reports.



Four-wheel Landing Gears being Installed on Production-model B-36 Superbombers at Consolidated Vultee Aircraft Corporation's Fort Worth, Tex., Plant, will Distribute the Bomber's 278,000 Pounds over a Greater Area than the Two 110-inch Wheels Used on the Experimental XB-36 Bomber. This Improved Weight Distribution, Coupled with Shortened Landing Runs Resulting from Reversible-pitch Propellers, will Enable the Giant Six-engine Plane to Utilize a Greater Number of Airfields. The Four-wheel Truck Type Gears are also Lighter, Safer in Event of Blowout, and have Tires that are Easier to Service. The Multiple-wheel Gears and a Bubble-type Pilots' Enclosure are the Chief Differences between the Experimental and the Production Bomber

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Fellows 36-Inch and Turret Type Gear Shapers

Two new gear shapers—one a 36-inch model, and the other a rotary unit having ten gear-cutting units mounted in a turret on a single base—have been developed by the Fellows Gear Shaper Co., Springfield, Vt. The 36-inch model is designed to cut both internal and external spur and helical gears having pitch diameters up to 36 inches, face widths of 5 inches, and diametral pitches of 3 for spur gears and 4/5 for helical gears. Helix angles up to 45 degrees can be cut with standard guides. Twelve reciprocating speeds ranging from 18 to 300 strokes per minute can be obtained from a selecting dial located at the front of the machine, and four rotary feeds are available through a four-speed transmission controlled by a lever. Other feeds can be obtained by changing the pick-off gears.

Limit switches and adjustable dogs control the depth of feed. The dogs are held on a drum mounted on a feed camshaft, which is rotated intermittently by a cam and ratchet driven by the crankshaft that reciprocates the cutter. The feed depth is controlled by the number and position of the dogs. Rotation of the work is determined at any depth of cut by a counter, which is mechanically driven from the lower index-wheel worm-shaft, and which operates electrical contacts at each complete revolution of the work.

The machine operates as follows: When the selector switch is turned on, the lubrication pump starts and power is imparted to the "start" button for the main motor. Pressing the "start" button starts the cutter reciprocation and the rotation of the cutter and work. The cutter is fed into the work until the first dog operates the limit switch, at which point the in-feed is stopped by a solenoid that locks out the ratchet-feed mechanism. This de-energizes the counter clutch coil to start a count of the work rotation. Upon completion of one rotation, the counter contact unlocks the depth-feed solenoid and the rotary feed progresses as before until the next dog engages the limit switch. This cycle is repeated for each dog until the final cut is taken, when the machine stops automatically.

The rotary gear shaper, shown in Fig. 2, comprises ten individual stations that can be set up either to cut single gears of the same size or different sizes and types of helical or spur gears having pitch diameters up to 12 inches, face widths up to 3 inches, and diametral pitches of 3/4 in the case of spur gears and 5/7 for helical gears.

For example, assume that it is desired to cut four different gears at one time and the relative cutting time on the gears is four, eight, twelve, and sixteen minutes. One station would be used for the four-minute gear, two for the eight-minute gear, three for the twelve-minute gear, and four stations for the sixteen-minute gear, the cycle time being set at four minutes. While it will require four complete revolutions of

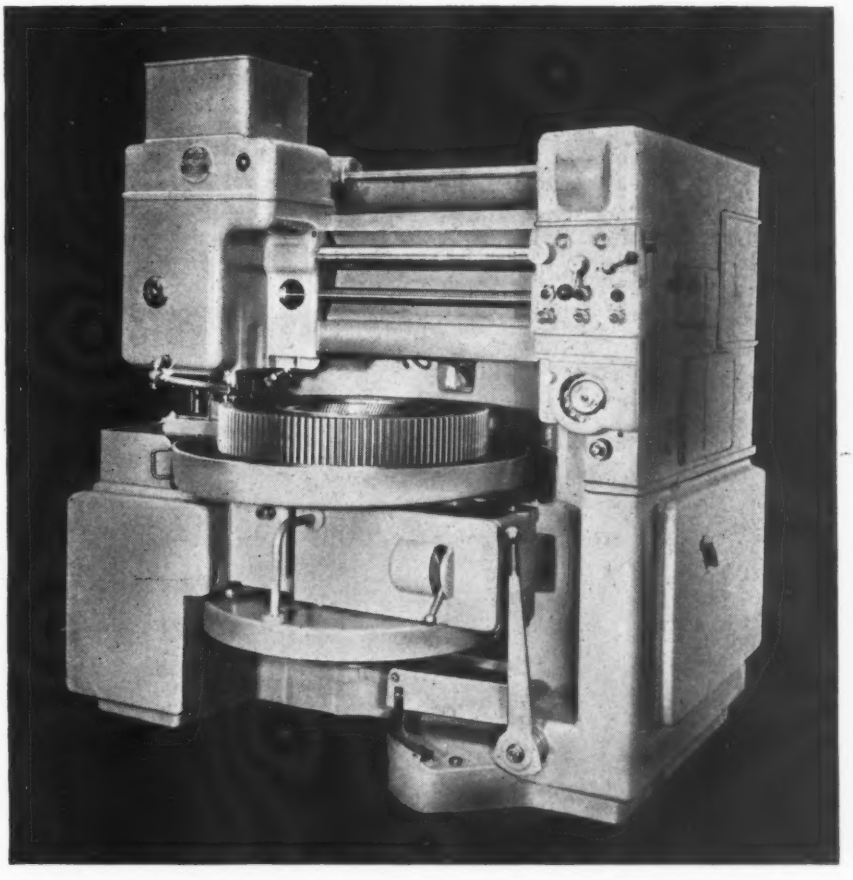


Fig. 1. Fellows Gear Shaper for Cutting Spur and Helical Gears up to 36 Inches Pitch Diameter

To obtain additional information on equipment described on this page, see lower part of page 228.

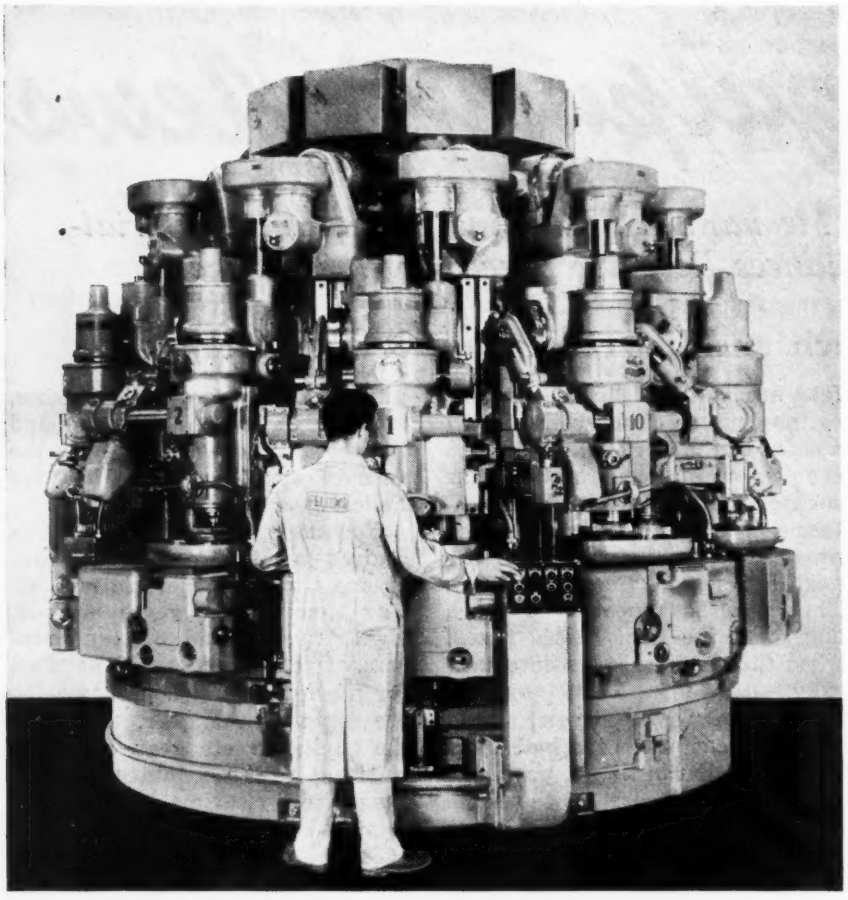


Fig. 2. New Ten-station Rotary Gear Shaper Developed by the Fellows Gear Shaper Co.

the turret to complete the sixteen-minute gear, at the completion of twelve revolutions of the turret, twelve gears of each size will be cut.

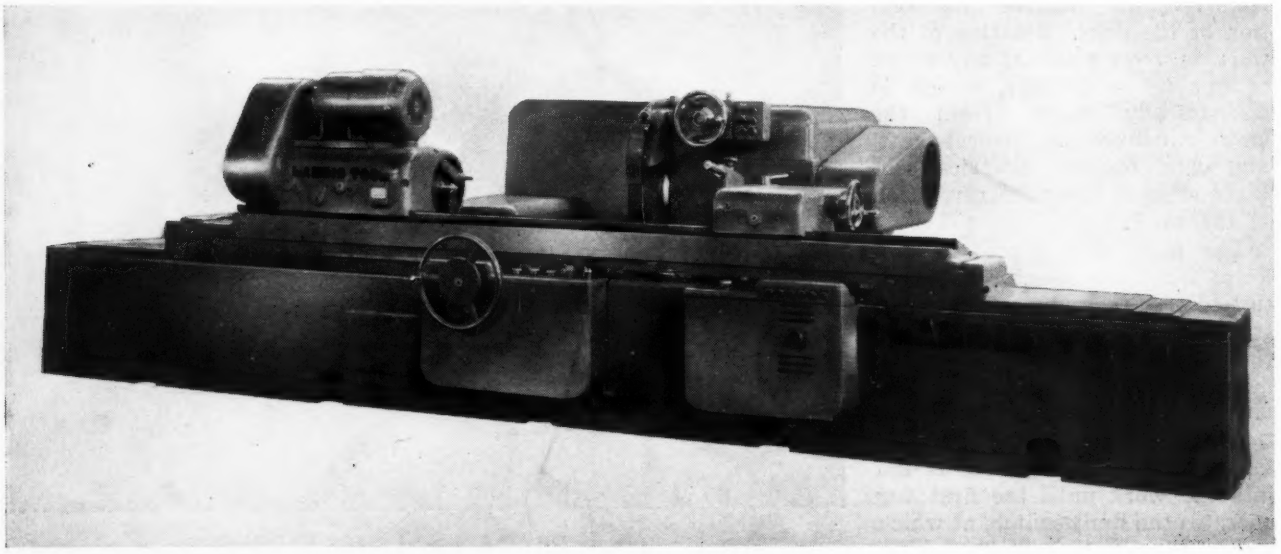
The cycle time for the turret is varied by change-gears, and ranges from 2 1/2 to 20 minutes. Each station is individually operated by a separate electrical motor and control, and stops automatically when the gear is completed. The entire machine is operated from a centralized push-button control panel located at the operator's position. 71

Landis Tool Co.'s Cylindrical Grinders

The Landis Tool Co., Waynesboro, Pa., has brought out three new types of plain cylindrical hydraulic grinding machines for finishing heavy work. The Type F grinder swings 14- and 16-inch work weighing up to 6500 pounds, and is available with lengths between centers ranging from 36 to 168 inches. The Type FF grinder will take work weighing up to 10,000 pounds and has a swing over the ways of 16, 20, or 24 inches. The length between centers on this machine ranges from 48 to 240 inches. The third model (Type FR) is designed for grinding rolls up to 10,000 pounds, and includes a built-in crowning and concaving mechanism. It is made in 16-, 20-, and 24-inch sizes, with center distances of 48 to 168 inches.

Among the new features of these machines are Microsphere wheel-spindle bearings that are pressure-lubricated and immersed in lubricating oil. A safety pressure switch prevents rotation of the spindle until a predetermined pressure is built up in the filtered oil lubricating system; failure of this system will automatically stop rotation. The lubricant used for the carriage guides is pumped from a separate reservoir in the bed.

The headstock is constructed for complete V-belt drive from motor to jack-shaft and jack-shaft to faceplate. All bearings are of the anti-friction type. A revers-



Plain Cylindrical Hydraulic Grinding Machine Built by the Landis Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

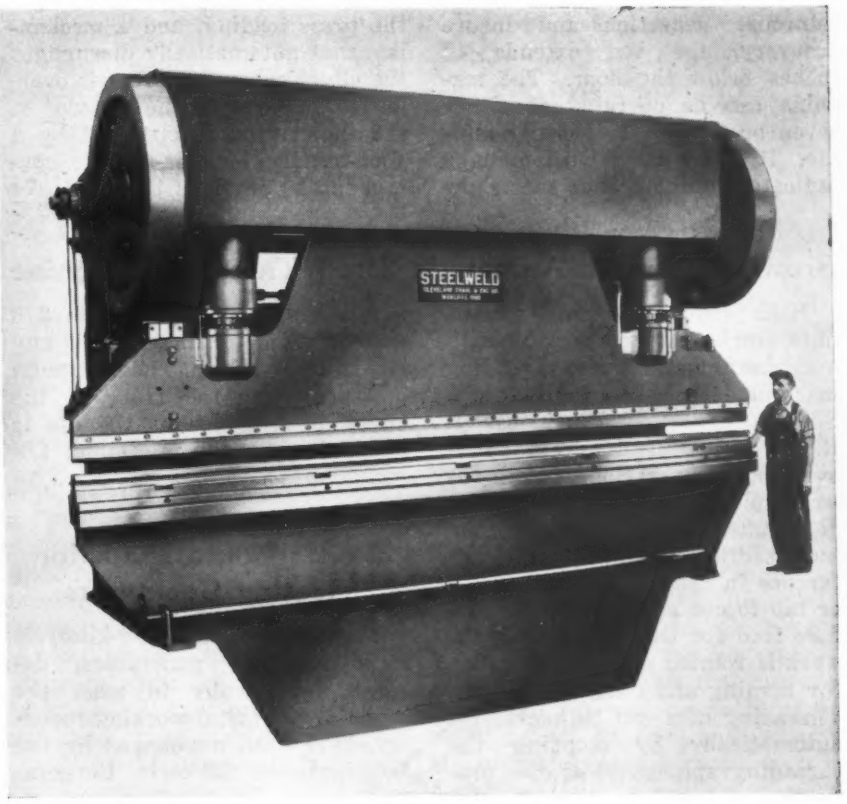
ible hydraulic motor actuates the carriage. Traverse speeds are infinitely adjustable from 3 to 90 inches per minute. A carriage tarry adjustment for traverse grinding is standard equipment on all models; tarry at either end or both ends may be selected.

A variety of grinding wheel feeds are obtainable to suit the work. They may be either electrically or hydraulically controlled or a combination of the two systems may be employed. Straight in feed for plunge grinding or feeds at each carriage reversal may be provided. 72

Machine for Making Standard Weight Pipe

The American Electric Fusion Corporation, 2600 Diversey Ave., Chicago 47, Ill., has developed a machine for converting strip steel into standard weight pipe with diameters ranging from 1/2 to 2 inches, inclusive. Coils of flat strip stock are transformed into electrically welded pipe at speeds up to 65 feet per minute, depending on the diameter. The pipe is formed, welded, scarfed, sized, straightened, and cut to length in one continuous operation.

This machine is designed to produce pipe that meets all required pressure tests and that conforms with the specifications for electrically welded American standard weight pipe. 73

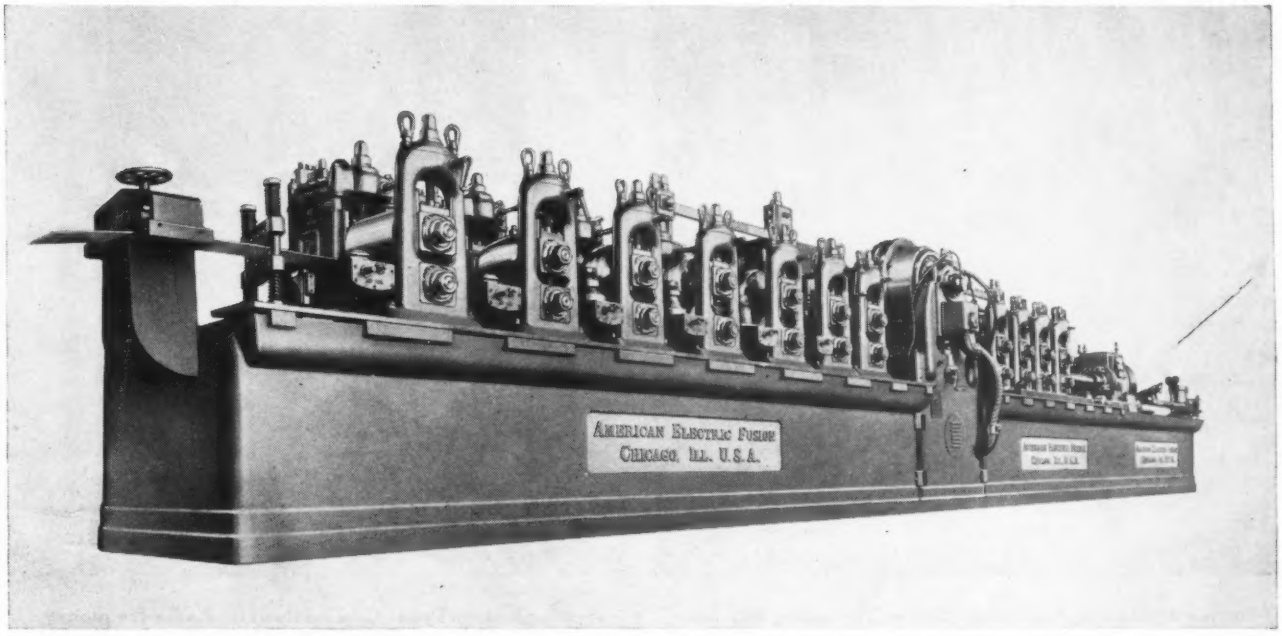


New Steelweld Bending Press Designed with a Bed that Extends below the Floor in Order to Minimize Deflection

Steelweld 500-Ton Bending Press

A 500-ton press with an unusually long bed that permits bending steel plate up to 3/8 inch thick by 20 feet long or 1/2 inch thick by 14 feet long has been added to the line of Steelweld bending presses manufactured by the Cleveland Crane & Engineering Co., 5401 E. 282nd St., Wickliffe, Ohio.

This press has a 20-foot bed and ram and a 21-inch bed extension on both ends that makes possible horning operations. To



Machine for Producing Pipe 1/2 Inch to 2 Inches in Diameter from Strip Steel

To obtain additional information on equipment described on this page, see lower part of page 228.

minimize deflection and insure accuracy, the bed extends 42 inches below the floor. The machine can be operated at either seven or twenty strokes per minute. It is equipped with tonnage indicators on both ends that show the press loading, and a mechanism that automatically disengages the clutch when the press is overloaded. The machine shown in the illustration is operated by a foot-treadle, but air-electric control can be provided if desired. 74

Brown & Sharpe Automatic Screw Threading Machine

High production of small screws, nuts, and bushings is possible with a new automatic screw threading machine designed by the Brown & Sharpe Mfg. Co., Providence 1, R. I., to take full advantage of overlapping operations. Both the work-spindle and threading spindle rotate in the same direction, but at different speeds; the difference in speeds permits the die or tap to cut at the required surface feed for threading while the work is rotated at suitable speeds for turning and other operations. Threading dies can be backed off automatically by stopping the threading spindle. For the production of bushings, the die spindle is used as a drill spindle.

Sixteen work-spindle speeds are available, ranging from 5000 to 454 R.P.M., and thirty-two threading spindle speeds from 7000 to 545 R.P.M., giving thirty-two changes of thread-cutting speeds ranging from 2000 to 91 R.P.M. The machine takes stock to 3/8 inch in diameter and threads any length up to 1 inch. The maximum distance from the front of the chuck to the face of the die is 2 7/8 inches; the minimum, 1/8 inch. 75

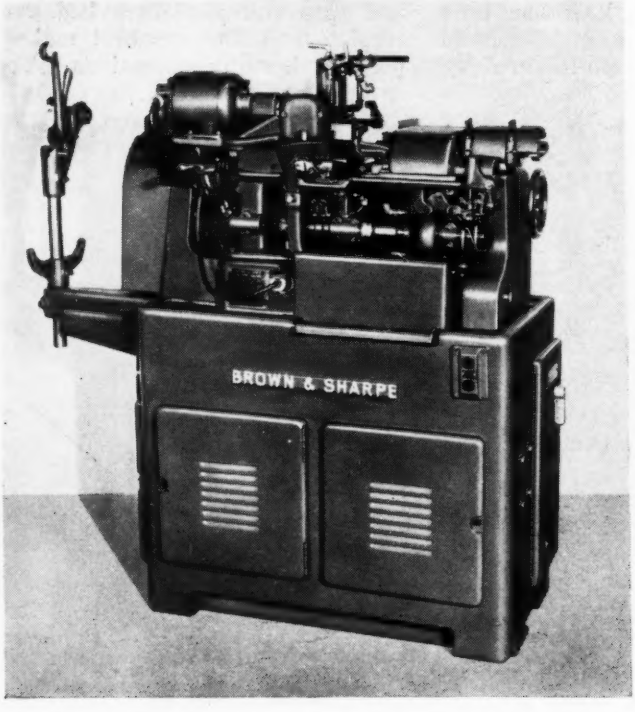
Westinghouse Induction Heating Generators

Three 20-kilowatt, 450-kilocycle radio-frequency generators, designed specifically to meet the needs of the metal-working industry, have been announced by the Westinghouse Electric Corporation, Industrial Electronics Division, Baltimore, Md. In the new models, the generator, work-table or sink, current transformers, and water fittings are consolidated into one unit. Type A is a single-position unit especially designed for brazing and soldering operations; Type B, also a single-position unit, is intended for hardening applications; and Type C is a two-position unit suitable for many soldering, brazing, and hardening applications. The latter unit is equipped with an automatic transfer switch to provide two independently controlled work positions.

Stepless power output control from 0 to 20 kilowatts provides flexibility in the operation of the generators, and insures uniform performance. 76

Unionmelt Automatic Flexible Welder

The advantages of submerged melt welding now can be made available anywhere in the shop with a new Unionmelt flexible welder developed by The Linde Air Products Co., Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. This machine is particularly useful for making welds that are inaccessible for fully automatic welding; making short welds where it is not worth while tc mechanize the operation; building up deposits of almost any size or shape; and depositing metal to repair weld or casting defects. The special feature of the ma-



Brown & Sharpe Automatic Screw Threading Machine Designed for the High Production of Small Screws, Nuts, and Bushings

Westinghouse Type C 20-kilowatt Radio-frequency Generator Designed Especially for Use in the Metal-working Industry

To obtain additional information on equipment described on this page, see lower part of page 228.

Unionmelt Flexible Welder

chine is that the welding nozzle, at the end of a 20-foot long flexible hose, can be moved from one weld to another without stopping to set up a track, carriage, or other guiding equipment.

The machine has a capacity of 900 amperes, and operates on either direct or alternating current, which may be supplied from any welding generator or transformer. External connections for the compressed-air hose, welding cables, the power supply, and the contactor and relay operating leads for the control units are all that are necessary to make it ready for operation. 77

Canedy-Otto Small Radial Drill

The Canedy-Otto Mfg. Co., Chicago Heights, Ill., has recently developed a "bantam" size radial drill press with a maximum capacity of 1 inch in cast iron. The new machine is available with a 3-foot arm and a 7-inch column. It has nine spindle speeds, is equipped with a single-speed motor operating at 900, 1200, or 1800 RPM., and has six rates of power feed. An independent fractional-horsepower motor is used to elevate the arm. All shafts are mounted on ball bearings.

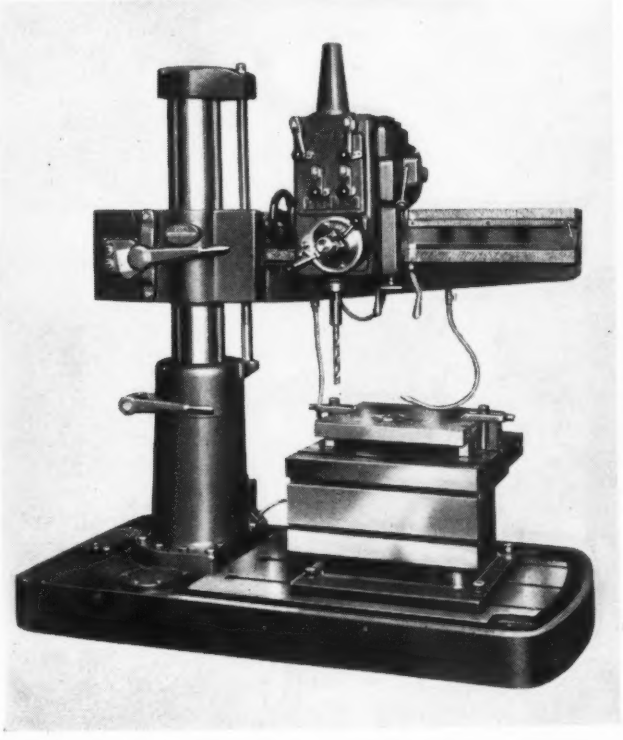
The machine has a semi-cast steel base with an integrally cast tank for a coolant system. The column is of tubular steel, the head and arm of semi cast steel, and the gears of hardened alloy steel. The feed clutch is an independent unit which permits feeding either upward or downward, and the main drive clutch is of the multiple-disk friction type which allows forward or reverse rotation for convenience in tapping. 78

Racine Hydraulic Metal-Cutting Saw and Hydraulic Pump

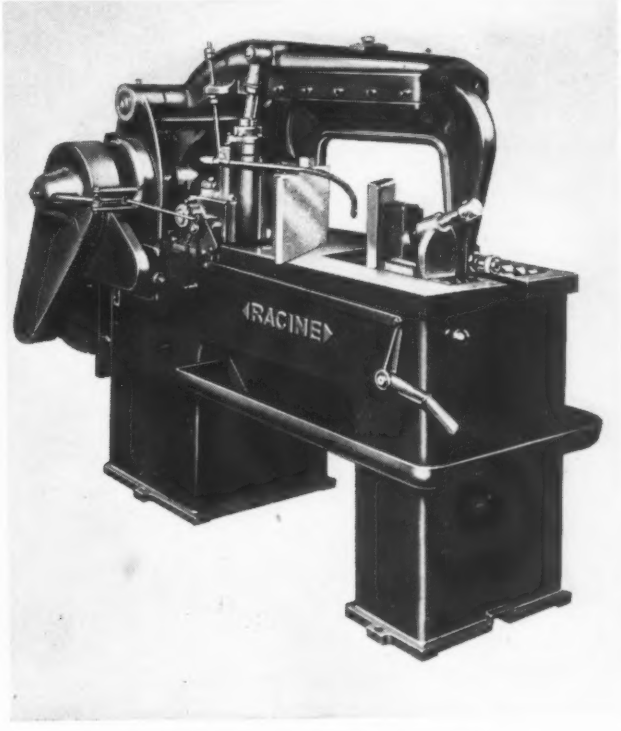
A fully hydraulic cut-off saw for all types of metal ranging in size up to 10 by 10 inches is a new development of the Racine Tool & Machine Co., Racine, Wis. The feed and pressure control, rapid traverse, and the lift on the non-cutting stroke of this "Oil Cut" model are all hydraulically operated. A single lever, located at the front of the machine, regulates the rapid traverse. A push-pull lever allows a gradual lowering of the frame and blade for measuring the cut-off lengths of stock.

Another development of the concern is a new model adjustable-volume vane type hydraulic pump, especially designed for use where space is limited. This unit can be installed in an area as small as 6 by 6 inches. At 1000 pounds per square inch pressure, it maintains a volumetric efficiency of 90 per cent, the volumetric output being controlled by a mechanical movement of the rotor ring.

Features of this pump include vanes of special steel provided with means of compensating for wear, and an anti-friction bearing rotor shaft mounting. 79



"Bantam" Size Radial Drill Built by the Canedy-Otto Mfg. Co.



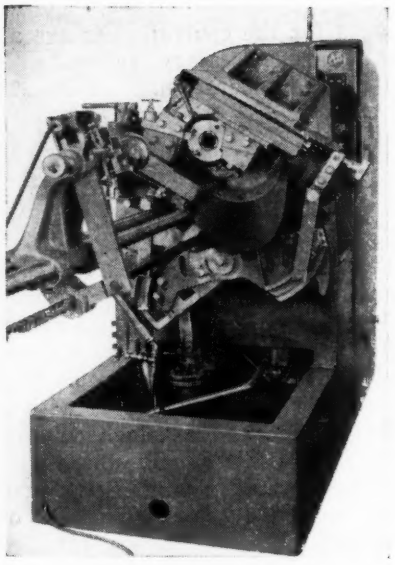
Hydraulic Cut-off Saw Developed by the Racine Tool & Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

Taft-Peirce Spline and Gear Grinder

A spline and gear grinder that produces fine pitch gears and splines to exceedingly close tolerances is being placed on the market by the Taft-Peirce Mfg. Co., Woonsocket, R. I. This machine is said to be particularly adapted for grinding precision gears and splines of small and medium size. It has a clearance from the center line of the work-arbor to the surface of the table of 4 1/4 inches and a distance between centers that is large enough to accommodate an 8-inch arbor.

The machine is designed with the same standard base column and spindle head that are employed in the Taft-Peirce precision surface grinder. It has hardened and ground ways; ball-mounted table, saddle, and column; and an anti-friction bearing spindle in the headstock. Automatic indexing is provided at the end of each stroke. Backlash and play are eliminated by a special driving dog equipped with a clamping device, and saddle and table locks insure positive locking of either cross or longitudinal travel. 80



Automatic Cutting-off Machine Brought out by Modern Machine Tool Co.

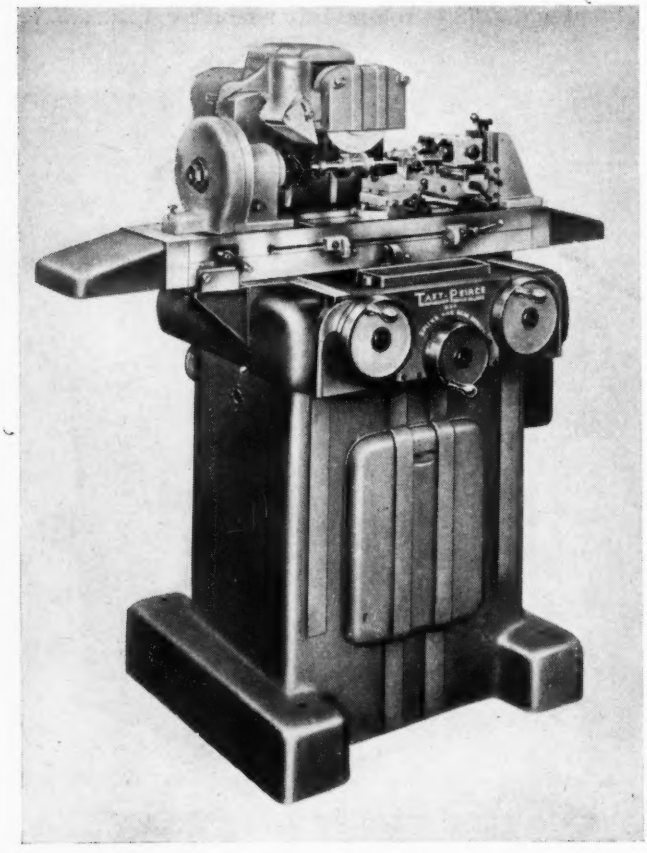
Automatic Cutting-Off Machine

The Modern Machine Tool Co., Jackson, Mich., has announced a new automatic machine for cutting off tubing, pipe, or solid bar stock. This automatic machine is similar in design to the manually operated machine manufactured by the company, and uses the same operating cycle, but it is much heavier than the manually operated model.

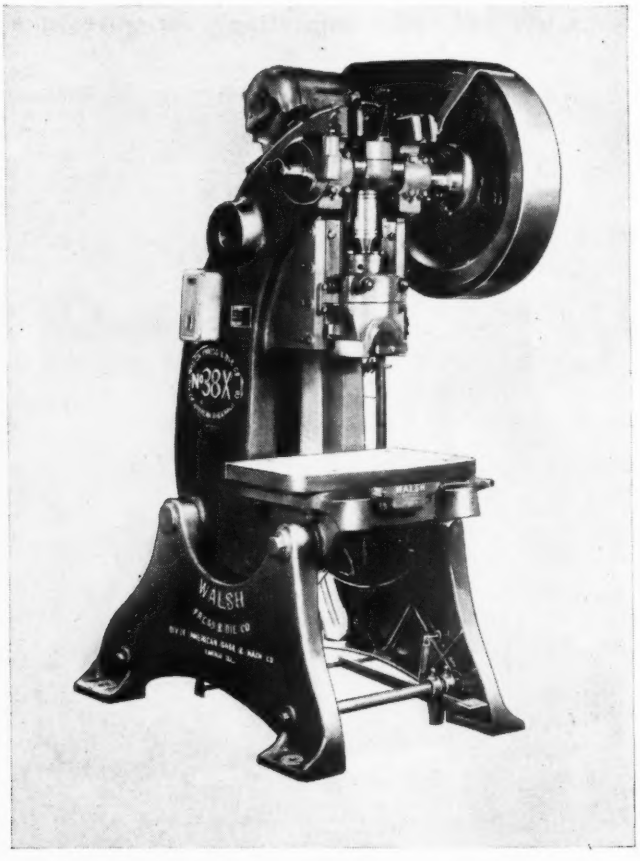
The cross-slides of the new machine are set at an angle to obtain better chip clearance, and the double live-roll stock feed will feed any length of stock through the spindle. As the stock is fed forward it strikes the trip-plate on the stop and starts the automatic cycle, which requires about 1 1/2 seconds plus the cutting time. The time for changing set-ups is practically the same as that for the manually operated machine. 81

Walsh Inclinable Punch Press

A 38-ton capacity, open-back, inclinable punch press has been added to the line of equipment manufactured by the Walsh Press & Die Co., Division of American Gage & Machine Co., 4709 W. Kinzie St., Chicago 44, Ill. This press can be used in the tool-room for the shearing in of dies and punches and for die try-outs. The large shut height and bolster plate area also make it adaptable for



Taft-Peirce Spline and Gear Grinder



Walsh 38-ton Inclinable Punch Press

To obtain additional information on equipment described on this page, see lower part of page 228.

certain notching, forming, and die-casting trimming operations where plenty of room is required.

This machine has a center distance between gibs of 17 inches, a bed area 18 by 26 inches, and a throat depth of 12 inches. It can be furnished in various sizes up to a 6-inch stroke in either a flywheel or back-geared type and with a variable-speed or conventional motor drive. 82

Westinghouse Automatic Welder

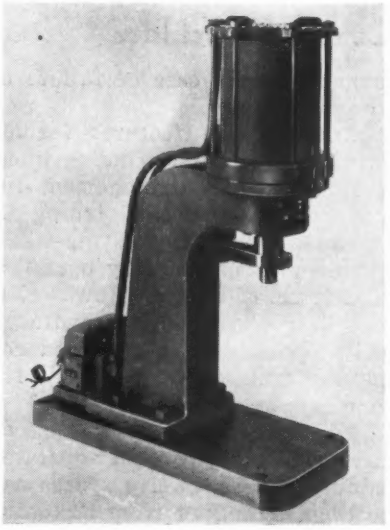
Complete equipment for automatically positioning and welding a variety of parts has been designed by the Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. This machine, known as the Weldomatic welder, consists of a welding head, control equipment, welding transformer, and work-positioning equipment.

The standard Weldomatic head is suitable for welding with either alternating or direct current, and has a capacity of 1200 amperes, alternating current, and 800 amperes, direct current. It is so designed that it can be rotated 360 degrees in the vertical or horizontal plane, and as a result can be mounted in any position for welding. The motor-generator set is driven by a 2-H.P. 220- to 440-volt, three-phase, 60-cycle alternating-current motor. Work-positioning equipment is supplied to suit the job. 83

Hannifin Small Air-Operated Arbor Presses

To meet the demand for fast operating, semi-automatic equipment for press-fit assembly operations, such as are required in the manufacture of electric motors, small tools, and bearing parts, the Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill., is building two air-operated, bench-mounted arbor presses designated Models M1 and M2. These machines are also suitable for light stamping, marking, and die cutting operations. Both presses are equipped with a new push-button controlled electric valve that eliminates manual valve operation.

The smaller model has a 4 1/2-inch diameter by 4-inch stroke



Air-operated Arbor Press Designed by the Hannifin Corporation

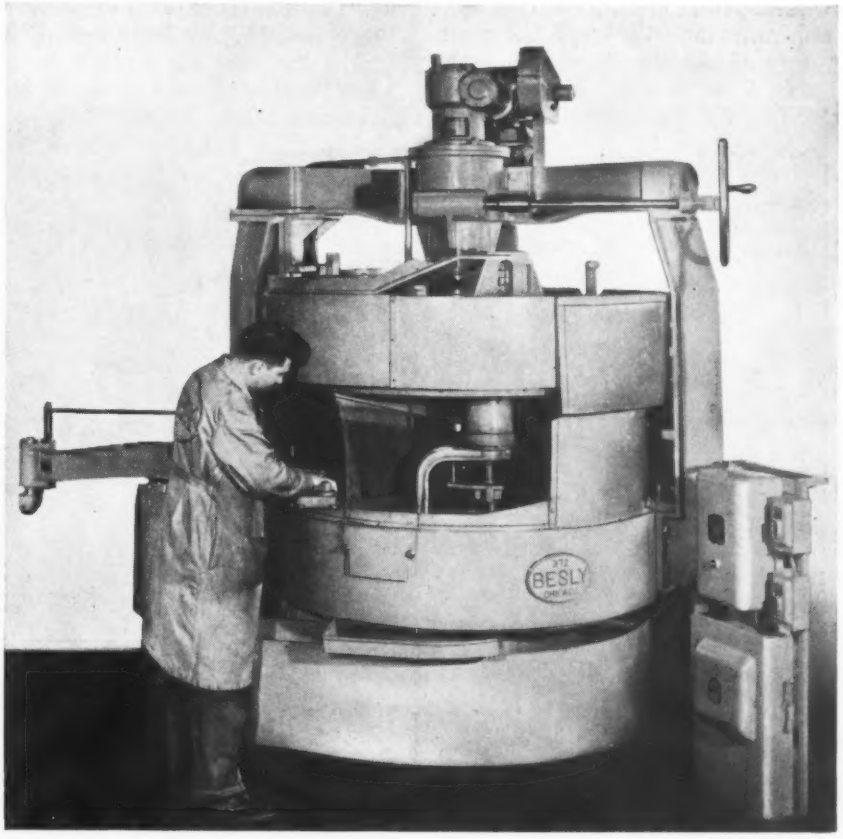
cylinder, and develops up to 1270 pounds ram pressure with 80 pounds air line pressure; it weighs approximately 210 pounds, and has a gap distance from the table to the ram of 6 inches.

The larger model is equipped with a cylinder that is 6 1/2 inches in diameter and has a 6-inch stroke. It is capable of developing ram pressures up to 2650 pounds. This machine has a gap distance from the table to the ram of 12 1/4 inches, and weighs approximately 375 pounds. In both presses, the stroke can be varied to meet work requirements, and either press can be supplied without a base for special mounting..84

Besly Vertical-Spindle Grinder

Charles H. Besly & Co., 118-124 N. Clinton St., Chicago 6, Ill., has put into production a new type 72-inch vertical-spindle grinder that is particularly suitable for grinding cast-iron gear housings, but can be adapted to many types of production work.

This machine has a power-driven rotary fixture into which the operator places the work. The rotary fixture and revolving work-holders carry the work through the grinding cycle at the rate of one revolution every sixty seconds. Four pieces are ground simultaneously, approximately 1/32 inch of metal being removed. When smaller work is ground, two or more pieces can be placed in each work-holder.....85



Vertical-spindle Grinder Developed by Charles H. Besly & Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

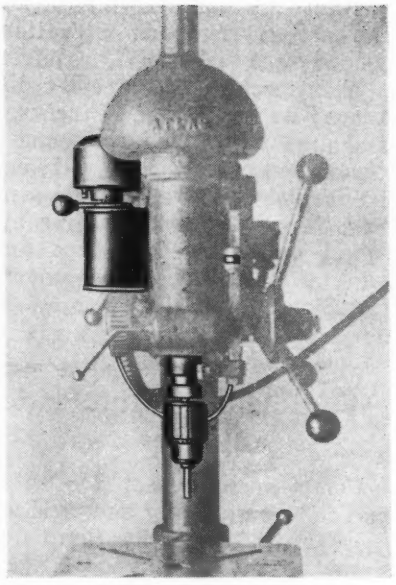
Cincinnati Filmatic Centerless Grinder

A new model Filmatic centerless grinding machine equipped with multi-shoe type spindle bearings and designed particularly for ease of set up has been announced by Cincinnati Grinders Incorporated, Cincinnati 9, Ohio. To facilitate set up, the supporting units for the regulating-wheel housing are mounted on an intermediate plate that has a swivel adjustment through a trunnion mounting on the bed. This type of mounting permits the operator to swivel the regulating-wheel slide and compensates for slight inaccuracies in truing the wheel. A handwheel adjusts the upper and lower slides in relation to each other or as a single unit when clamped together.

The grinding-wheel and regulating-wheel spindles are mounted on Filmatic multi-shoe bearings. These bearings consist of segments or shoes that are pivoted to allow the entrance of wedge-shaped oil films. The oil wedges maintain accurate dead-center rotation of the spindle under any load developed by the grinding operation. Both wheel-spindles are automatically lubricated; a pressure switch in the grinding-wheel system and lubricating system automatically stops the main motor drive in case of failure of the oil-pump.

Other design features include straight hydraulic grinding-wheel truing, with an arrangement for cam-controlled profile truing if desired. The regulating-wheel truing unit is manually operated, and is screw-driven. However, it can be replaced with a hydraulically operated unit arranged for profile truing, as required for some types of in-feed work.

The regulating-wheel speeds are changed by lever-operated sliding gears. Twelve speeds are available, ranging from 12 to 300 R.P.M. A centrifugal motor-driven pump mounted in a tank at the rear of the machine circulates coolant. An individual stream of coolant is directed to the truing diamond by means of a three-way valve in the cooling line. 86

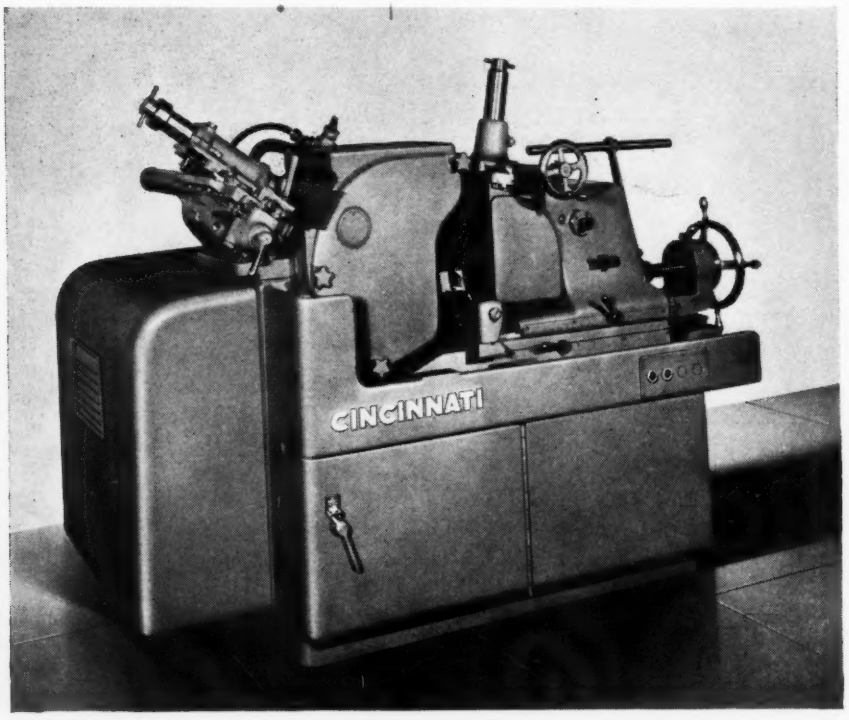


Swich - O - Matic Reversing Control for Drill Presses or Engine and Turret Lathes

"Swich-O-Matic" Reversing Control

A new mechanical control device produced by the Swich-O-Matic Co., 124 W. Hadley St., Whittier, Calif., can be used on drill presses, engine lathes, and turret lathes with motors of 220, 440, and 550 volts whenever accurate automatic spindle-reversing operations are required. This unit, known as the Swich-O-Matic reversing control, is said to increase machine production by permitting the threading of non-ferrous materials at higher speeds.

Tap sizes are limited only to the chucking capacity of the machine, thereby eliminating the many sizes of tapping heads for a full range of tapping operations. The control can be used in conjunction with a multiple drill head, thus transforming a drill press into a semi-automatic multiple tapping machine. It can be operated either automatically or manually on intermittent operations without changing the machine set-up.....87



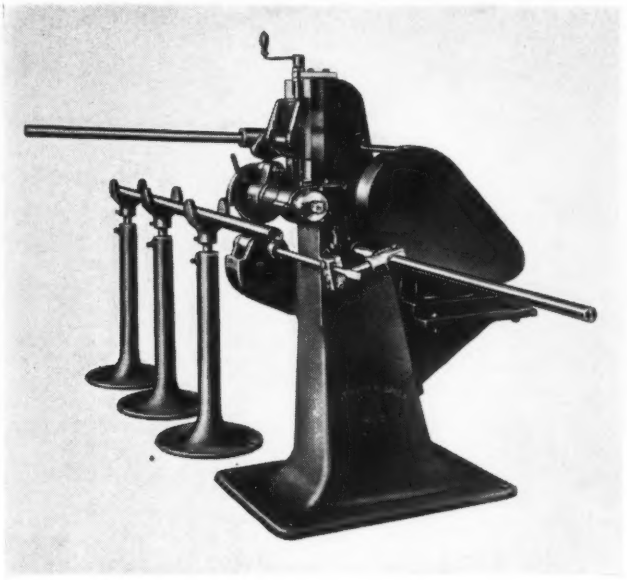
Cincinnati Filmatic Machine for Centerless Grinding Equipped with Multi-shoe Type Spindle Bearings

Steen Pipe and Tube Cutter

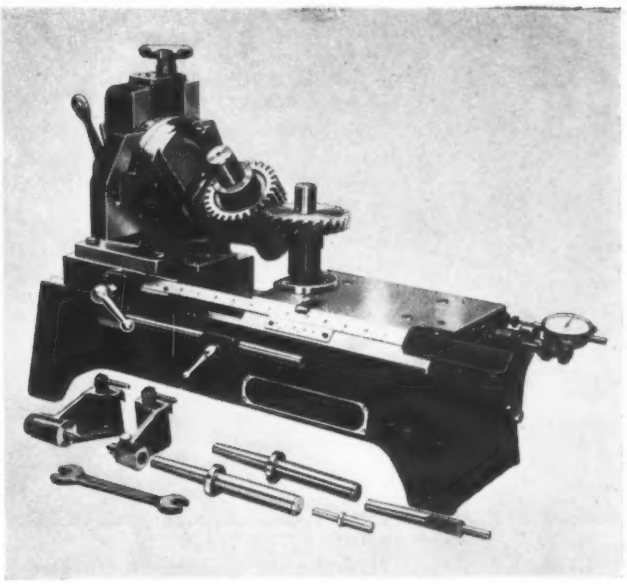
The Steen high-speed pipe and tube cutter illustrated is now being manufactured by the Continental Machine Co., 1952 Maud Ave., Chicago 14, Ill., in three sizes (Nos. 3, 6, and 12) for cutting pipe or tubes from 1/2 inch to 3 inches, 1/2 inch to 6 inches, and 3 to 12 inches in diameter, respectively. An attachment can be obtained for the No. 3 and No. 6 models which enables pipe from 1/8 to 1/2 inch in diameter to be cut.

The shaft and the gears of the machine are made of chromium-

To obtain additional information on equipment described on this page, see lower part of page 228.



Steen High-speed Pipe and Tube Cutter



Parkson 9-inch Gear-tester

nickel steel; the cutter-block rolls are of hardened tool steel, and are provided with roller bearings and tool-steel pins that allow the pipe to turn freely. The cutter blades are designed with standard double bevels or long bevels.

A gage that is automatically released as the cutter is engaged with the pipe is available on the Nos. 3 and 6 cutters. 88

Parkson Gear-Tester

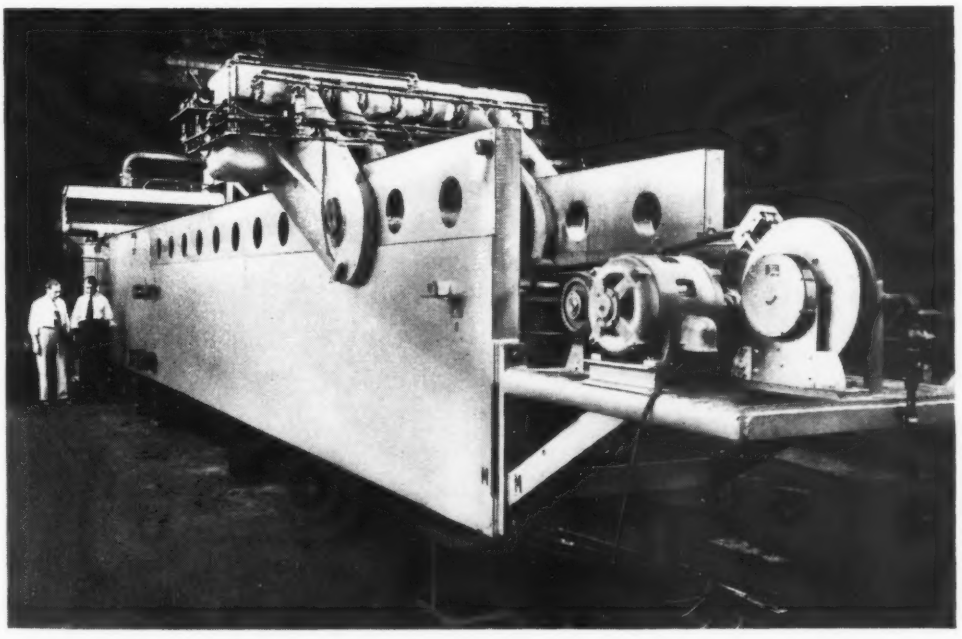
The 9-inch Parkson gear-tester, distributed in this country by the George Scherr Co., Inc., 199 Lafayette St., New York 12, N. Y., has been redesigned, and several features have been added to provide for more efficient operation. In addition to the precision scale and long vernier used for setting the center distance, the new machine incorporates an adjustable stop-rod that eliminates the necessity of repeating scale settings when testing a number of gears of the same size. The stop-rod is set and clamped in position. To change the set-up, the left-hand slide is moved out of the way; the gears on the arbor are replaced; and the slide is then brought back into the same position against the stop.

Either combination or single-purpose models are available for testing spiral, spur, bevel, or worm gears. 89

Large-Size Hydraulic Plate Stretcher-Leveller Machine

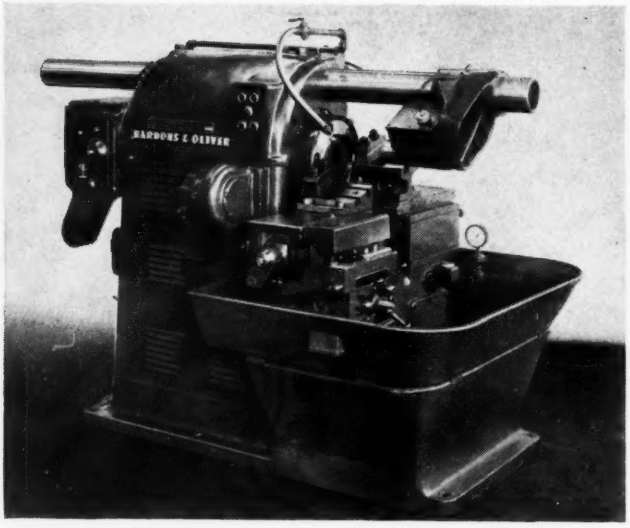
A stretcher-leveller machine of special design, believed to be the largest ever built, was completed recently by Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y. This machine is of the self-contained oil hydraulic type, has a capacity of 825 tons, and will accommodate plates up to 100 inches in width.

The maximum length of plate handled on this machine is 33 feet, and the minimum length 7 feet. Two grip-heads are provided, one being actuated by the hydraulic stretching cylinder, while the position of the other is adjustable to compensate for the varying length of the plates. Operation of the machine is by remote control. Pressure adjustment over a wide range permits handling thinner and narrower plates. 90

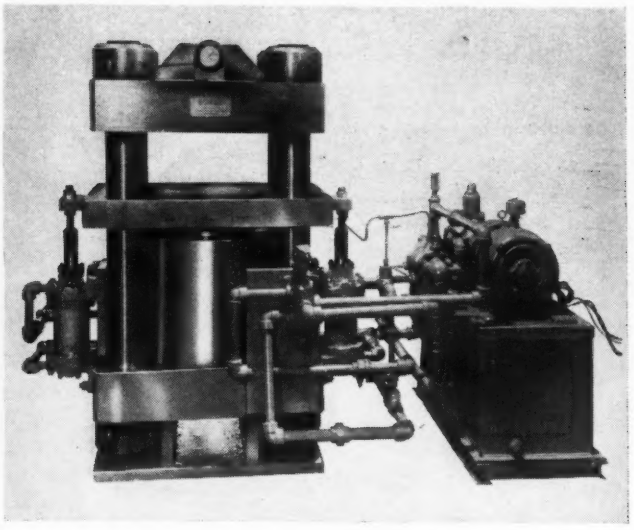


Hydropress Plate Stretcher-Leveller Machine

To obtain additional information on equipment described on this page, see lower part of page 228.



Bardons & Oliver "Hydralectric" Cutting-off Machine



Hydraulic Die-hobbing Press of 400 Tons Capacity

Bardons & Oliver Cutting-Off Machine

A high-speed "Hydralectric" cutting-off machine that can also be used for boring, turning, drilling, and chamfering of tubing, pipe, or solid bar stock has been developed by Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio. The stock is fed through the hollow spindle by a motor-driven roller feed. A stock stop equipped with a solenoid-operated release gages the length of the work to close limits. Two hydraulically operated cut-off slides, one front and one rear, are tooled to perform the cutting operation. Chamfering can be done either by a drop-off tool on the rear slide or by an overhead chamfering attachment actuated automatically by the front slide. For other operations, a third or longitudinal slide can be furnished.

The collet chuck has a capacity of 5 1/2 inches, and is so designed that it opens and closes automatically in relation to the movements of the slides. The 10-H.P. main drive motor is enclosed in the machine column. Four spindle speeds are obtainable by sliding gears in the drive transmission, and additional speeds through pick-off gears. A geared pump supplies the hydraulic power. 91

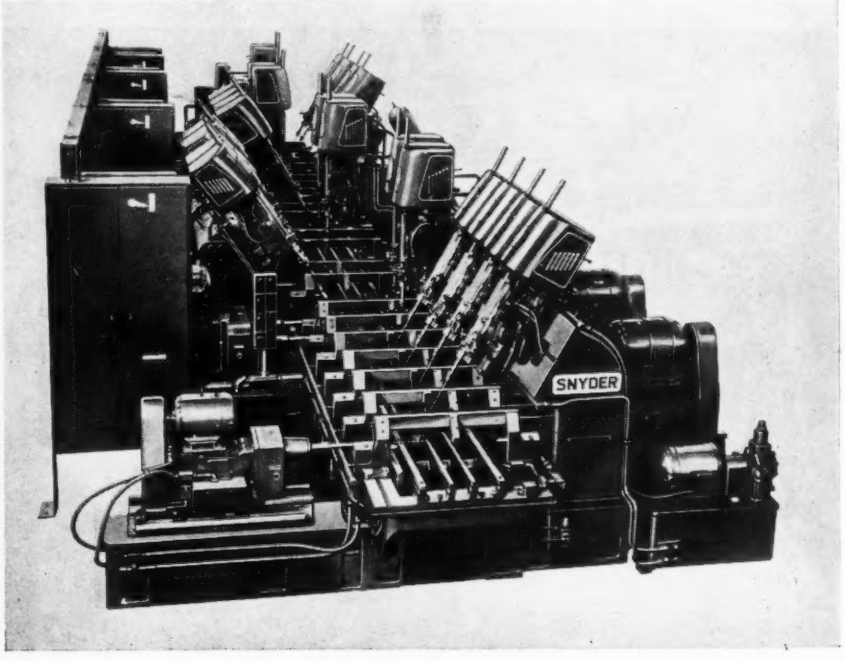
Schill Hydraulic Die-Hobbing Press

A 400-ton hydraulic die-hobbing press of all steel construction is being placed on the market by the Edward Franklin Schill Corporation, 39 Cortlandt St., New York 7, N. Y. This four-rod press has an upward moving ram with a stroke of 6 1/2 inches and a daylight opening of 12 inches. The stroke can be adjusted from 3/4 inch to the maximum of 6 1/2 inches; and pressure is also adjustable.

The hydraulic unit is operated by a 7 1/2-H.P. motor. The free closing speed of the press is 75 inches per minute, and the opening speed is 150 inches per minute. The press is manually operated.....92

Snyder Special Crankshaft Drilling Machine

A machine designed especially for the high-speed drilling of oil-holes in steel crankshafts has been developed by the Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich. The machine automatically indexes the work-pieces past self-contained automatic vertical, horizontal, and angular machining units that drill and deep-drill all oil-holes, and drill and ream two Welch plug holes in the crankshafts. At each station, the work-pieces are posi-



Snyder Special Crankshaft Drilling Machine

To obtain additional information on equipment described on this page, see lower part of page 228.

Fig. 1. New Heald Multi-Way Bore-Matic

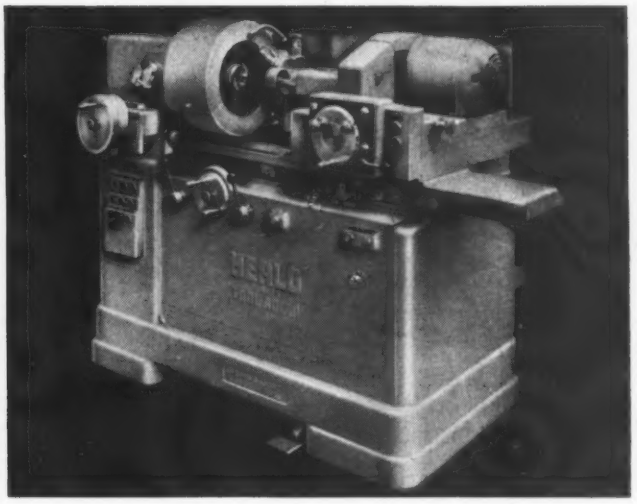


Fig. 2. Heald Tool-room Internal Grinding Machine

tioned and clamped by hydraulically-actuated mechanisms that operate on an automatic cycle controlled from a push-button.

Twenty-four Avey standard deep-hole units and eight horizontal units are employed in this twenty-eight station machine. Coolant is supplied from a central system and chips are cooled by a chip conveyor traveling the full length of the machine. The unit is approximately 18 feet wide and 39 feet long. 93

Le Maire Automatic Indexing Trunnion Machine

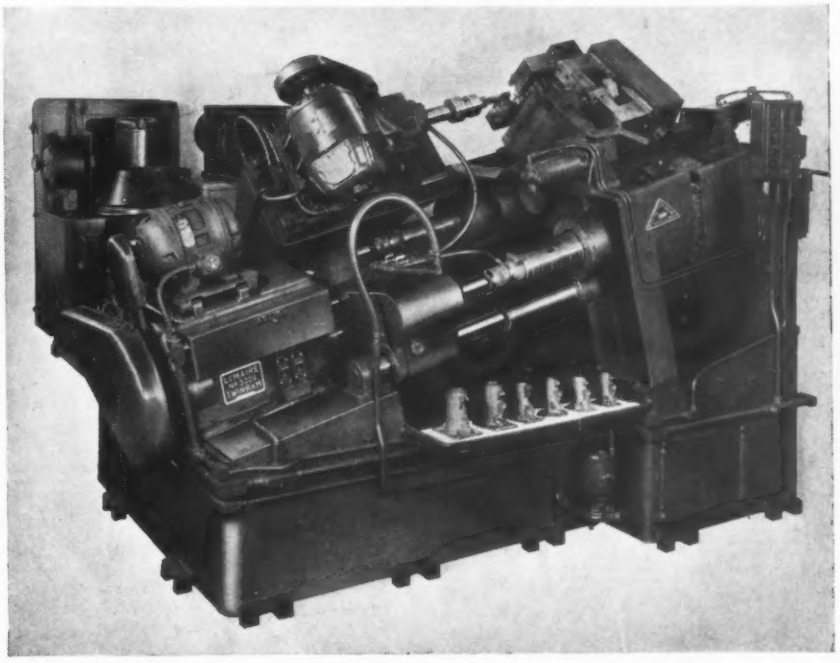
A single-end five-station automatic indexing trunnion machine for boring hydraulic jack bodies has been developed by the Le Maire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich. The machine consists of a rigid fabricated base that houses a coolant system and supports the trunnion indexing mechanism; a twin-ram hydraulic drilling unit with a three-spindle boring head; and a master lead-screw tapping unit that is mounted on a hydraulically actuated sub-slide. All units are driven by variable-speed motors that provide infinite control of spindle speeds, so that a constant cutting speed can be maintained for all parts.

The fixtures are hydraulically operated and are of the self-centering vise type; they are clamped and unclamped by air cylinders mounted on the trunnion support at Station 1. A production of about 150 pieces per hour can be attained. 94

Heald Bore-Matics and Grinding Machines

The Multi-Way Bore-Matic shown in Fig. 1 is one of a new line of machines developed by the Heald Machine Co., Worcester 6, Mass. Furnished in two sizes as a "bi-way" model and in two sizes as a "tri-way" model, these machines are designed to bore two or more holes from various directions simultaneously. The various units of a machine can be operated separately if desired, and up to three individual boring heads or a special multiple-spindle head can be installed on each unit. As with other Heald Bore-Matics, these machines are capable of performing boring, turning, chamfering, facing, grooving, and fly cutting operations.

Complementing the line of machines referred to is the tool-sharpening machine shown in Fig. 3, which is designed to lap sharp edges to correct shapes. With this machine, accurate adjustment for any desired shape of tool can be easily made, after which the operator inserts the tool in the holder, flicks the operating switch, and the tool is sharpened automatically. Odd-shaped tools can be finished on an off-hand grinding attachment using a fine-grit diamond wheel; a coarse wheel for roughing tool surfaces



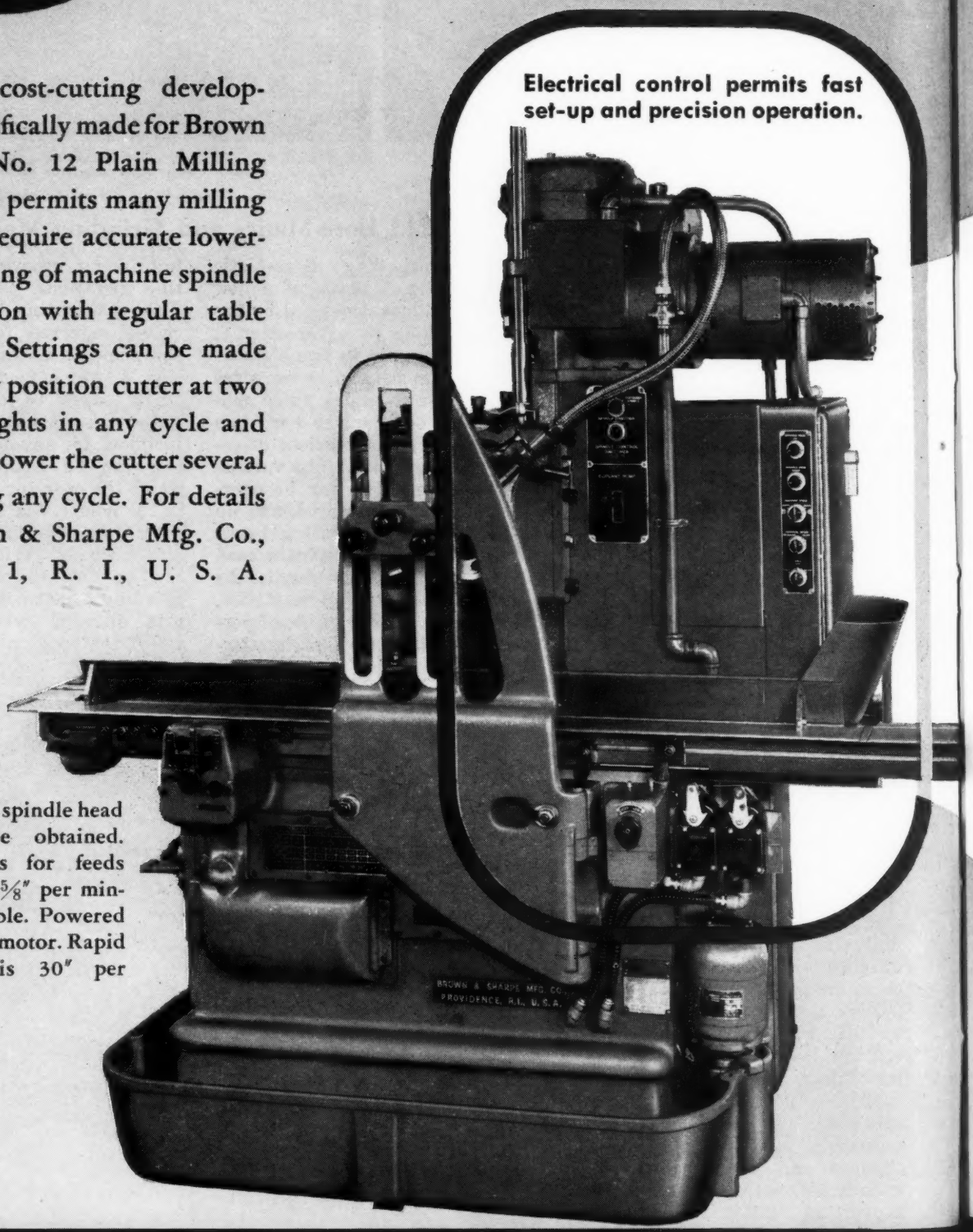
Le Maire Automatic Indexing Trunnion Machine

To obtain additional information on equipment described on this page, see lower part of page 228.

NEW Spindle Power Feed

FOR NO. 12 PLAIN MILLING MACHINES

THIS NEW cost-cutting development is specifically made for Brown & Sharpe No. 12 Plain Milling Machines. It permits many milling cycles that require accurate lowering and raising of machine spindle in conjunction with regular table movements. Settings can be made to accurately position cutter at two different heights in any cycle and to raise and lower the cutter several times during any cycle. For details write Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

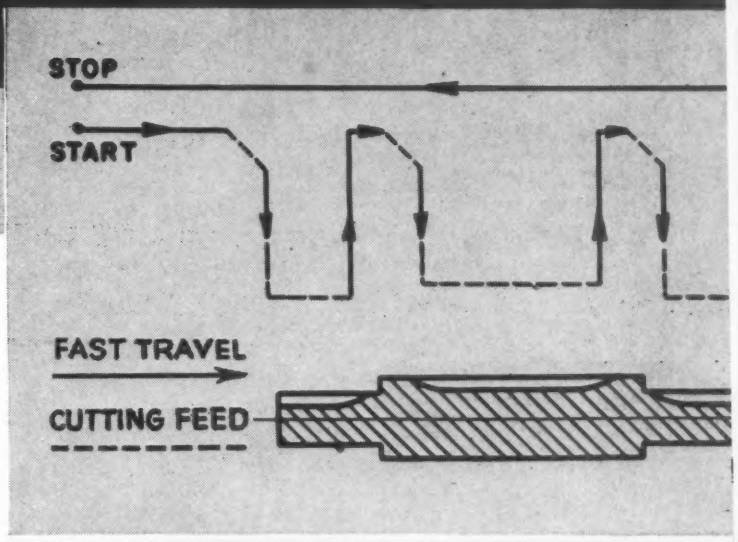


Electrical control permits fast set-up and precision operation.

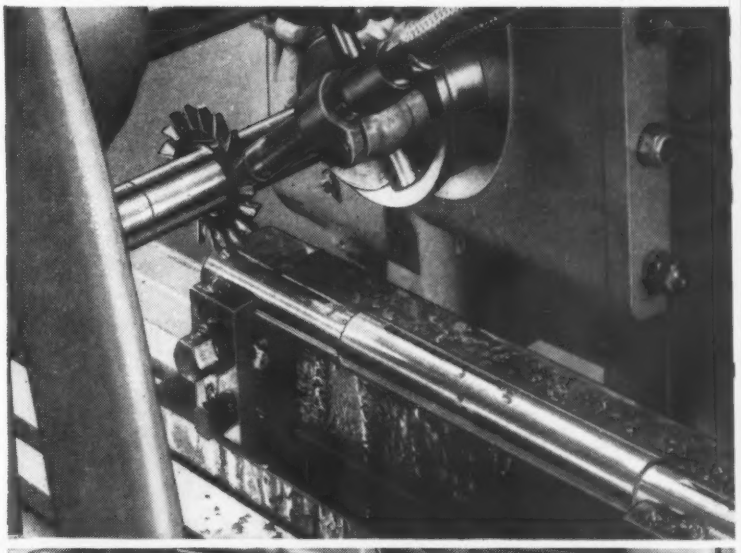
Wide range of spindle head feeds can be obtained. Pick-off gears for feeds from ½″ to 7⅝″ per minute are available. Powered by brake-type motor. Rapid travel rate is 30″ per minute.

BROWN &

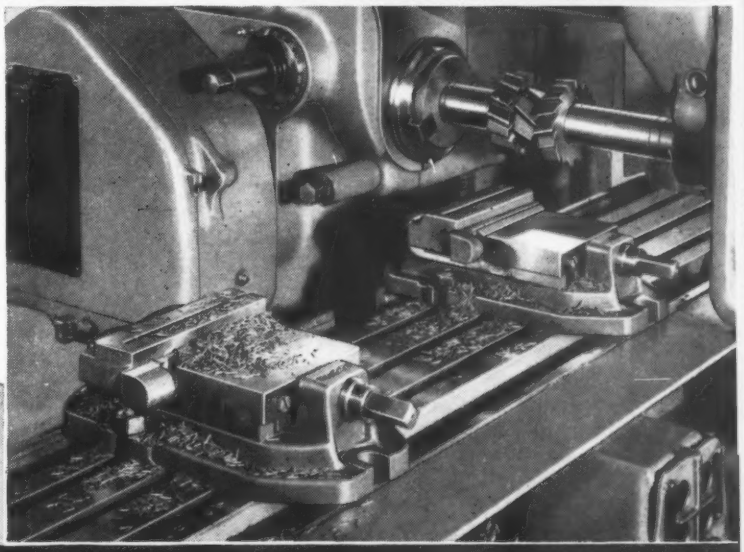
gives more work, with fewer set-ups



THE DIAGRAM at right shows one of many cycles made available by this new device. Horizontal arrows are for table direction, vertical arrows for spindle head direction, and the type of job is shown beneath the cycle. Cycles can be made with machine table starting in either direction. For information about a cycle that may simplify your milling, consult our Milling Engineering Service.



MILLING THREE KEYWAYS, as shown at the right, requires that the cutter operate at two different heights above the machine table. This operation is done automatically with the Spindle Power Feed Mechanism using cycle shown above.



CLIMB MILLING AT BOTH ENDS of table, *with the same cutters*, is made possible with this double fixture set-up. It is a continuous cycle with the spindle head power feed being used to raise the cutters to clear the work which has just been loaded in the second fixture. Climb milling makes possible increased feeds and longer cutter life. Often permits efficient milling of pieces difficult to hold.

SHARPE

B·S

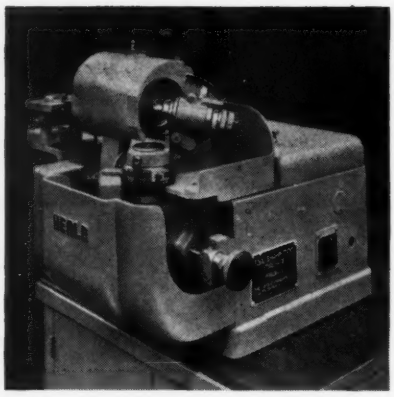


Fig. 3. Heald Tool-sharpening Machine

preliminary to finish-grinding can be provided.

Another new machine developed by the Heald Machine Co. is the tool-room internal grinding machine illustrated in Fig. 2. Specially designed for rapid handling of tool-room work, this grinder is readily adaptable to a large variety of parts and range of sizes. The work-head can be swiveled to provide a wide angular capacity for taper work, and a sine-bar attachment can be applied for high-precision settings. Other features include isolation of the pump and motor units, improved ring type cylinders with special distortion-free mountings, self-adjusting brakes, and constant hydraulic feeds and speeds. 95

Covel Surface Grinder

A new surface grinder has been brought out by the Covel Mfg. Co., Benton Harbor, Mich., which is designed to accurately grind tools, dies, chip-breakers and similar work, but is also suitable for many production jobs. Features include simplified controls, prelubricated spindle bearings, and a hardened spiral pinion and rack. The ways are protected from dust, and the 1/2-H.P. motor is enclosed in the base. The grinder is made in bench and floor models, and a wet grinding attachment is available at extra cost.

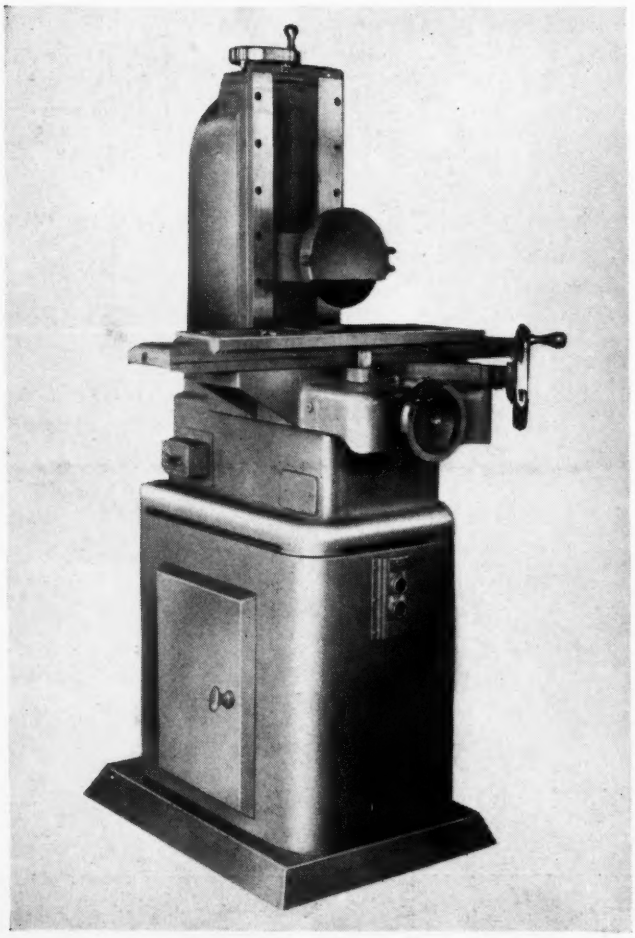
The machine has a longitudinal table travel of 12 inches, a cross travel of 6 1/8 inches, and a height under the 7-inch diameter wheel of 9 inches. It occupies a floor space of 36 by 44 inches. The floor model weighs 825 pounds...96

Federal Projection Welder and Double-Roll Seam Welder

The Federal Machine & Welder Co., Department 18, Plant 2, Warren, Ohio, has developed a special triple-head projection welder, shown in Fig. 1, for welding mounting brackets to cooling fins on compressor assemblies. With a machine cycle time of approximately five seconds, this machine produces 150 assemblies per hour.

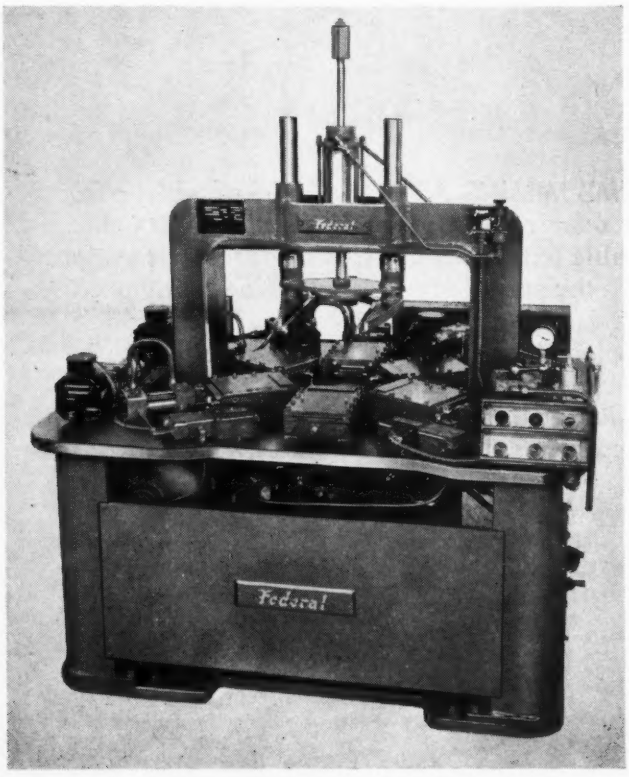
The welder is equipped with two locating current-carrying dies and one hydraulic-cylinder operating clamping die. The three projection heads are hydraulically operated, and incorporate spring clamping devices for locating the mounting brackets. The welding heads have an equalizer which insures the application of equal pressure at all four projections.

The welding heads operate in conventional type slides, and are so arranged that the brackets are held to a tolerance of plus or minus 0.010 inch for the two different compressor-mounting bracket sizes which the machine is capable of welding. The water-

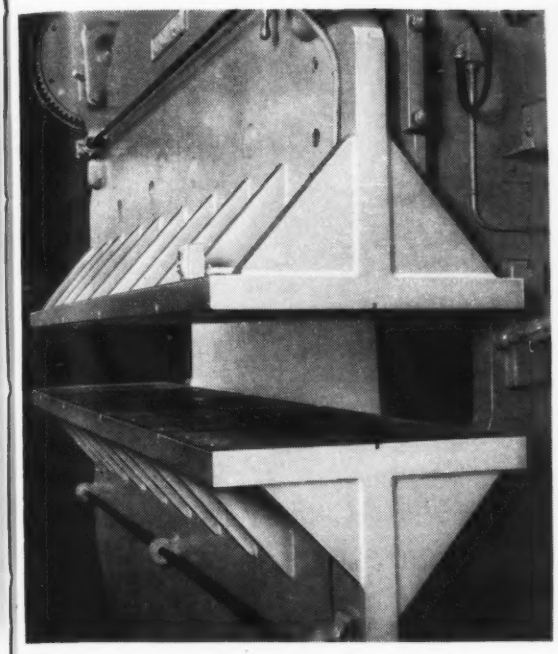


(Left) Surface Grinder Built by Covel Mfg. Co.

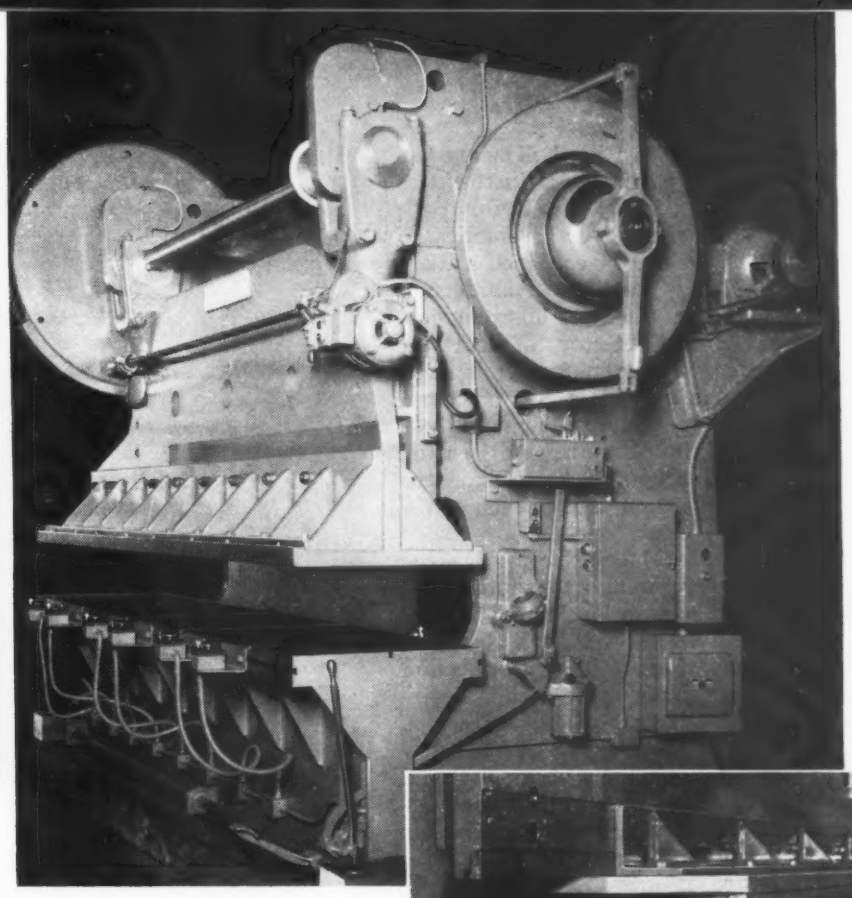
Fig. 1. (Below) Triple-head Projection Welder Made by Federal Machine & Welder Co.



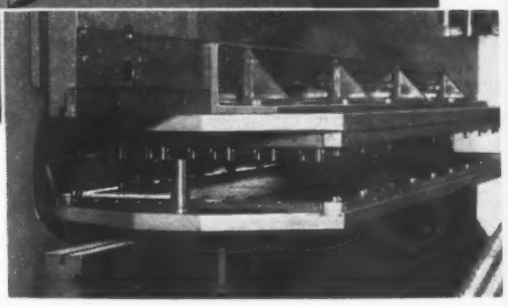
To obtain additional information on equipment described on this page, see lower part of page 228.



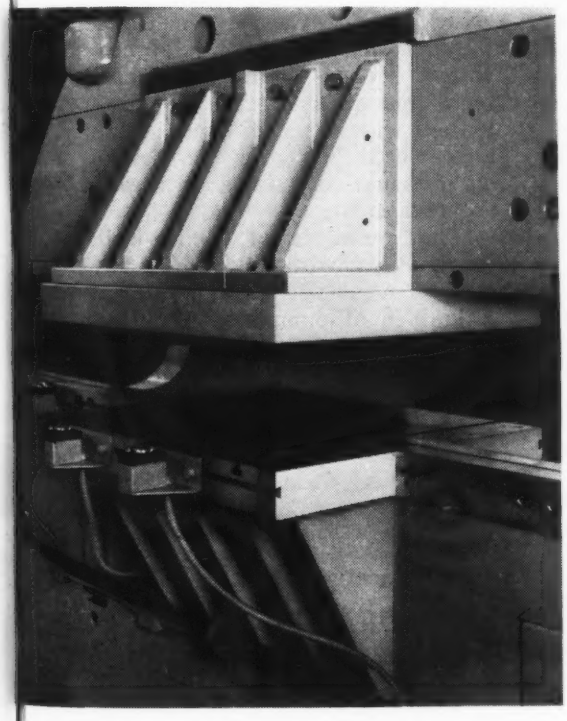
Large area, permanent wide bed and ram for press work



Large area, removable upper brackets



Large area, removable upper and lower brackets



Short, special purpose, removable upper brackets

JUMBO DIE AREAS..

on CINCINNATI PRESS BRAKES

With Cincinnati wide rams and beds, Cincinnati Press Brakes are now being used for both PRESS and PRESS BRAKE work.

These wide rams and beds are of two basic types—the permanent type for Press work only; the removable bracket type for general purpose requirements. With removable brackets, Cincinnati Press Brakes are dual purpose and function as Presses but also retain all the versatility of a Press Brake.

Both removable and permanent types of wide rams and beds are furnished in dimensions and areas to fit your particular requirements. We illustrate some of the combinations available.

Investigate!! Our Engineering Department will be glad to advise you on the profit and production possibilities of this new development in your shop. Write for Catalog B-2.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

cooled welding head dies are designed to permit an adjustment of the mounting bracket for both sizes of compressor assemblies.

The welder is equipped with a 150-KVA welding transformer wired for 440-volt, 60-cycle current with eight steps of heat regulation. One transformer is used, with one side of the transformer secondary winding connected to each of the clamping and locating current-carrying dies, and the other side connected to each of the welding heads.

The double-roll traveling-head series seam welder shown in Fig. 2 is another new development of the company. This welder is especially designed for use in strip mills and in other plants where it is desirable to join strip ends or skelps for long machine runs. This new 125-KVA welder unit can be used to adapt any strip mill for continuous operation. The machine is supplied in four sizes for 38-, 48-, 56-, and 66-inch strips. 97

Heim Self-Aligning Flanged Ball Bearing

The Heim Co., of Fairfield, Conn., has announced a new self-aligning flanged ball bearing. This is a double-row ball bearing with an extended inner race for locking on the shaft and with grooved outer races. It is said to be so constructed that it compensates for misalignment and deflection in shafts, and can be used in some cases to overcome errors in machining and mounting of parts. It will take axial thrusts in either direction, and is designed for relatively light loads and medium speeds.....98

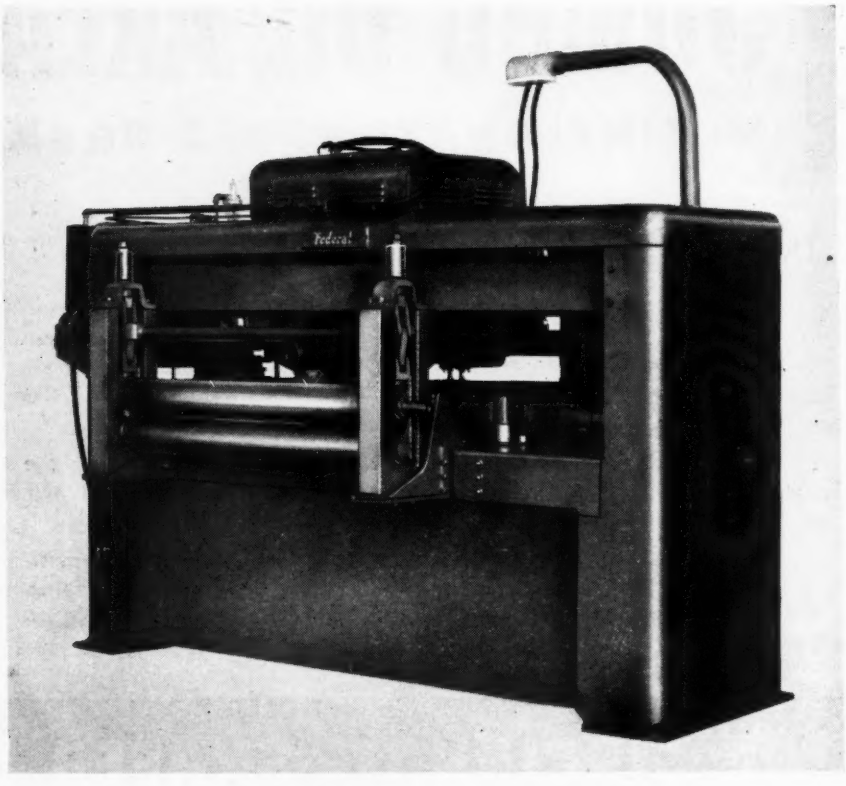
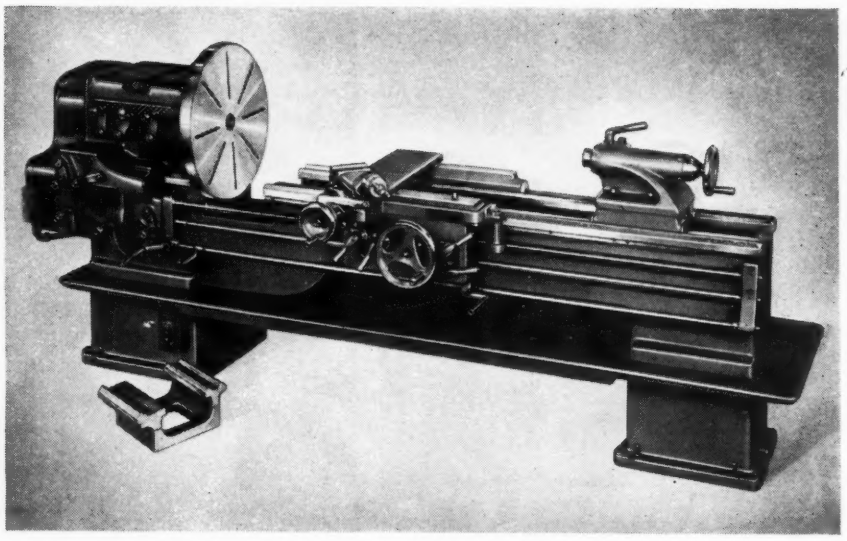


Fig. 2. Federal Double-roll Traveling-head Seam Welder for Joining Strip Ends



Sidney Gap Lathe Available in 14-, 16-, 18-, and 20-inch Sizes

Sidney Gap Lathes

Gap lathes in 14-, 16-, 18-, and 20-inch sizes have recently been brought out by the Sidney Machine Tool Co., Sidney, Ohio. These new lathes are designed with a twelve-speed sliding spur-tooth geared headstock that provides a wide range of speeds, and a gear-box through which forty-eight changes of feeds and threads are obtainable.

The apron is of double-wall construction with all shafts rotating on anti-friction bearings. A built-in oil-pump and filter insure lubrication to all apron bearings and gears, as well as to the bed ways and cross-slide. The bed is constructed with four longitudinal walls and double cross girts, spaced 12 inches apart.....99

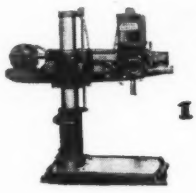
Instrument for Use in Statistical Quality Control Systems

A new transparent plastic instrument that consists of a distribution curve, a scale for analyzing the frequency distribution of any product characteristic, such as length, weight, diameter, or strength, and a square is being made available to the trade by the Hunter Pressed Steel Co., Lansdale, Pa., for use in conjunction with statistical methods of quality control. By following a set of instructions, the operator can quickly picture product distribution in scale relation to specified limits.....100

To obtain additional information on equipment described on this page, see lower part of page 228.

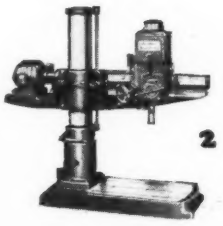
Which SUPER SERVICE will suit your JOB?

For greatest savings in drilling cost The Cincinnati Bickford Tool Company offers a complete line of 34 different sizes and types of drilling machines. One of these machines will cut your drilling costs more efficiently. Our engineers will help you select the proper machine for your work, or if you prefer, send for any or all of the bulletins pertaining to the machines that interest you.



1

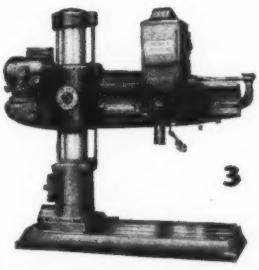
1. The smallest SUPER SERVICE Radial Drill manufactured by The Cincinnati Bickford Tool Company, as described in Bulletin R-26A, has a 7½" diameter column and a 2½' arm length. This machine is furnished with 6 speeds and 3 feeds and a 1 HP driving motor.



2

2. The 9" Diameter Column SUPER SERVICE Radial Drill, as described in Circular R-21B, is built in either a 3' or 4' arm length with 9 speeds and 4 feeds powered with a 3 HP driving motor.

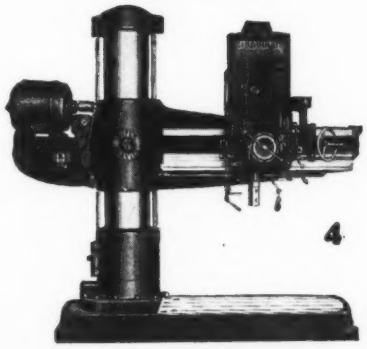
3. The new SUPER SERVICE Simplified Radial Drill, as described in Bulletin R-28, is built with a 3', 4' or 5' arm length having 11" diameter column. 12 speeds and 6 feeds are powered with a 5 HP driving motor.



3

4. The 36-speed 18-feed SUPER SERVICE Radial Drill, as described in Booklet R-29, is furnished in 11 different standard sizes, ranging from 4' to 8' arm lengths and 13" to 19" diameter columns. These machines are furnished with 7½ or 10 HP driving motors.

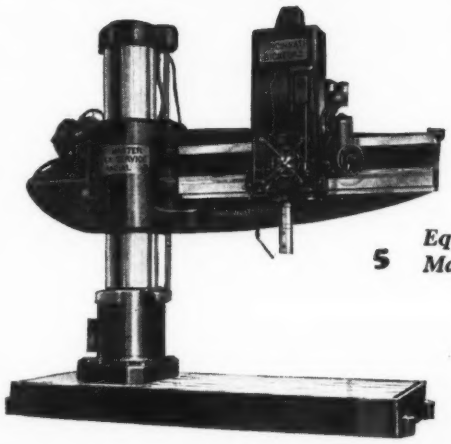
5. The SUPER SERVICE Master Radial Drill, as described in Circular R-22, is built in 7' to 12' arm lengths and in 22" and 26" diameter columns. This machine has 36 speeds and 18 feeds powered by motors from 20 to 40 HP.



4

6. The SUPER SERVICE Portable Horizontal Drilling Machine with 6 power feeds and 1½ HP driving motor is more fully described in Bulletin HR.

7. The SUPER SERVICE High Production Manufacturing Type Uprights have many of the advantages of the general purpose drilling machines but, due to their simplified construction, they are much more economical. They are furnished in 21", 24" and 28" sizes with 3, 5, 7½ or 10 HP driving motors. Booklet U-27 will furnish you more complete details.



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8. The new SUPER SERVICE Precision Drilling Machine is especially suited to operations in conjunction with an automatic spacing table. This 36-speed 18-feed 15 HP motor machine is more completely described in Circular FH.

9. The SUPER SERVICE General Purpose Upright Drilling Machines, as described in Booklet U-25, are furnished in 21", 24" and 28" sizes. From 8 to 12 speeds and 4 to 9 feeds. The machines are powered by either 3, 5 or 7½ HP motors.

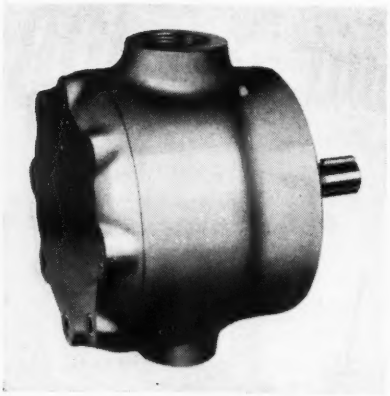
10. The SUPER SERVICE Jig Boring Machine, as described in Bulletin U-26B, is furnished in 12 speeds and 9 feeds with a 3 HP driving motor.

Equal Efficiency of Every Unit Makes the Balanced Machine

SUPER SERVICE

THE CINCINNATI BICKFORD TOOL CO.

Oakley, Cincinnati 9, Ohio, U. S. A.



Hydraulically Balanced Constant-displacement Pump

Sundstrand Constant-Displacement Pump

The Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., has added a constant-displacement, hydraulically balanced pump to its line of hydraulic equipment. This pump has been designed and tested for continuous operation at 1000 pounds per square inch pressure; for intermittent service, pressures up to 1500 pounds per square inch can be utilized.

The pumps will be available in three sizes, with capacities ranging from 2 to 75 gallons per minute. Interchangeable cartridges provide four capacities within each of the three basic sizes. This cartridge sub-assembly simplifies pump inspection and service and provides means for quick change of pump rotation and pump capacity. At present, the intermediate size in any of the four capacities —10, 13 1/2, 20 1/2, and 27 1/2 gallons per minute—can be furnished. 101

Stow "Streamliner" Flexible-Shaft Machines

Improved performance, safety, and appearance are features of the new "Streamliner" flexible-shaft machines being placed on the market by the Stow Mfg. Co.. Binghamton, N. Y. Both the motor and variable-speed drive mechanism are contained in a housing that covers all moving parts and shields the mechanism from damage. The flexible shaft is driven by V-belt stepped pulleys; speed changes and belt adjustments are made by turning a concentric spindle that is locked in position by a knob on the top of the housing. No wrench is required for this operation. The 6-foot flexible drive-shaft has an oil-resistant casing and coil reinforcement, and the ball-bearing hand-piece is equipped with a detachable wheel-arbor.

A choice of mountings and power and speed ranges is available. The pedestal type machine illustrated is equipped with a 1/2-H.P. motor; the suspended type machine, with either a 1/2-, 3/4-, or 1-H.P. motor; the low-mount pedestal type unit, with a

Stow Flexible-shaft Machine

3/4- or 1-H.P. motor; and the bench type model, with a 1/2 H.P. motor. Speeds for all 1/2-H.P. units range from 1725 to 6900 R.P.M., and speeds for the 3/4- and 1-H.P. models from 1150 to 5750 R.P.M.....102

Airco Automatic "Heliwelding" Equipment

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., has placed on the market two new "Heliwelding" units—a machine type electrode-holder and an automatic unit for welding thin sheets of stainless steel and light-weight metals, such as aluminum and magnesium.

The electrode-holder (Fig. 1) is designed to be mounted on a Radiagraph or other suitable traveling type mechanism for moving the holder along the weld joint or for fixed-position use with the work moving beneath the arc. It has the same barrel and rack as standard 1 3/8-inch diameter machine gas-cutting torches.

The automatic unit (Fig. 2) is designed for continuous operation. It consists of a holder, holder carriage, and control box. This unit is electronically controlled, and maintains a constant arc length. By compensating for set-up irregularities, it assures a continuous weld of consistent dimensions and quality.

Both of the new units have a welding current capacity of 300 amperes, and are insulated for use with the high-frequency current often required for arc-starting and stabilization in welding. The machine type holder can be used with either alternating or direct

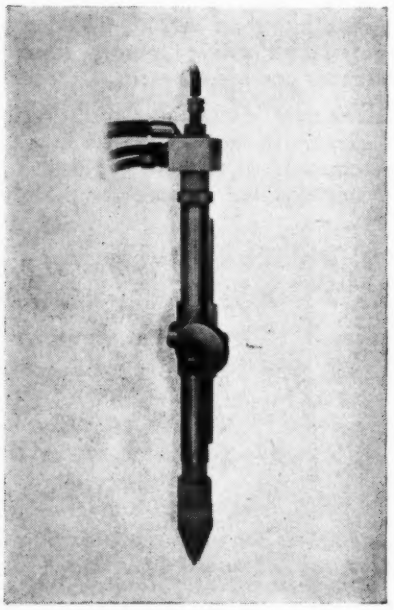


Fig. 1. Machine Type "Heliweld" Holder Made by the Air Reduction Sales Co.

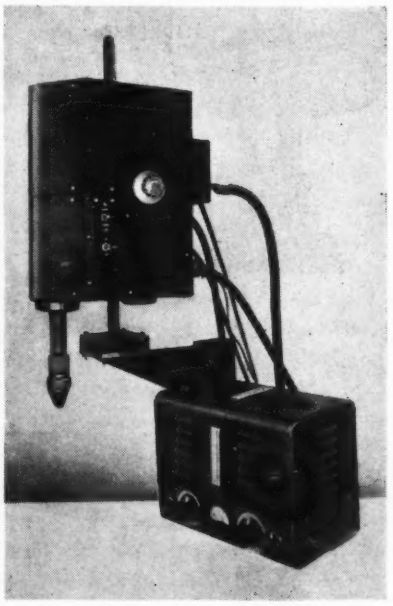


Fig. 2. Airco Automatic "Heliweld" Unit Designed for Continuous Operation

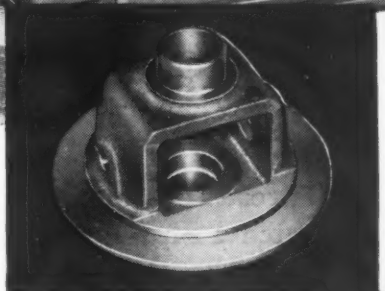
To obtain additional information on equipment described on this page, see lower part of page 228.

MODERNIZE YOUR SHOP ...Cut your Costs!

You Can't Make 1948 Products Economically on Old Equipment

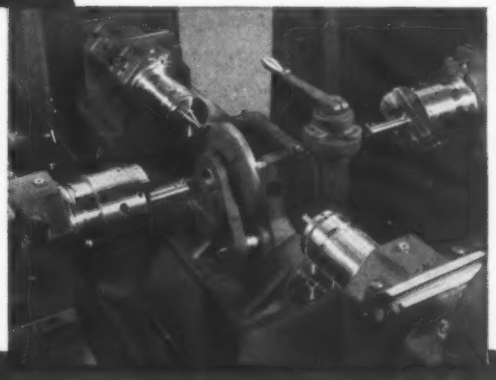
Producing in greater quantity at a lower unit cost is "a must" today for production men . . . to offset increased man-hour costs and to meet competitive prices. One direct way to streamline production and to cut costs is to modernize with Ex-Cell-O Semi-Special Way Machines—they are built by combining one, two, three or four standard, self-contained way units with a fixture unit to suit the individual work. These Ex-Cell-O Precision Machines offer four definite advantages: *A special machine to suit the work—it's actually built for the specific job; holes bored simultaneously from 2, 3, or 4 sides—speeds production; low first cost—built up from standard units; way units can be re-arranged to suit new work—machine won't be obsoleted by part changes.*

Note typical use of an Ex-Cell-O Way Machine to the right. Send for catalog with many varied applications—ask for Bulletin No. 31631.



Above: **Ex-Cell-O Four Way Precision Boring Machine. The four way units are electrically interlocked and controlled from the push button station on the right front unit.** *Left:* **Malleable iron differential case in which two inside counterbores are finish bored and chamfered and two cross holes are bored.**

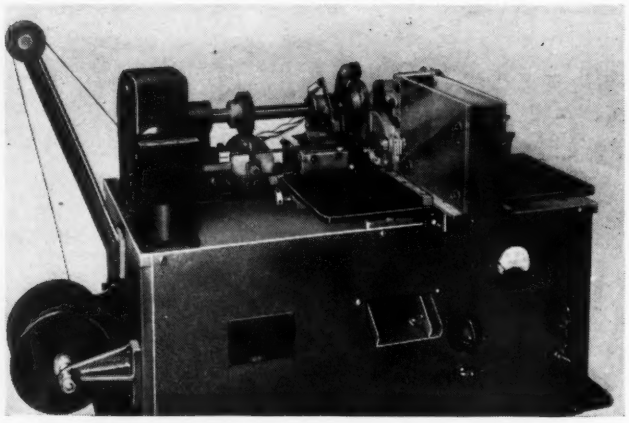
Right: **Close-up view of part in fixture and boring spindles. Note that boring bars on left front and right rear spindles are carried on tool slides that are retracted to allow tools to enter holes, are moved out to finish inside counterbores, and again retracted for withdrawal.**

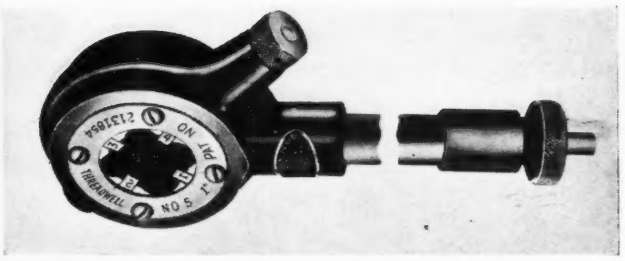


XLO
EX-CELL-O *for* PRECISION

EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines, and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches, Broach Fixtures and Broach Grinders • Counterbore Sets • Grinding Spindles • Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts





(Above) Self-oiling Pipe-threader Made by the Threadwell Tap & Die Co.

(Left) Automatic Welding Machine for Small Parts Developed by Tweezer-Weld Corporation

current, while the automatic unit operates only on direct current. The holder used on both types of equipment is water-cooled, and will take either tungsten or carbon electrodes up to 3/16 inch in diameter. It weighs 28 ounces, and is about 10 inches long.....103

Meyco Carbide-Inserted Drill-Jig Bushings

A line of carbide-inserted drill-jig bushings that are said to insure high accuracy and more productive machine time because of their longer life has been brought out by the W. F. Meyers Co., Bedford, Ind. A hardened steel ring inserted above the top carbide ring protects both the carbide and the drill from impact shock, thus combining the characteristics of a hardened steel bushing with the advantages of tungsten carbide at the points of wear. These Meyco bushings, of special hardened alloy steel, are manufactured to the dimensional standards of the American Standards Association. 104

Automatic Welder for Small Parts

A new machine has been developed by the Tweezer-Weld Corporation, 1060 Broad St., Newark, N. J., for welding and shaping small metal parts automatically. The parts are fed to a turret either by hand or automatically from a hopper. Before or after the welding process, the components can be shaped, so that the welded parts, when they leave the machine, are ready for assembly into the final product.

The equipment is said to be effective in attaching light wire from a spool to parts fed automatically from the hopper. One of the chief uses of the machine is for the welding of tabs to radio-tube cathodes. 105

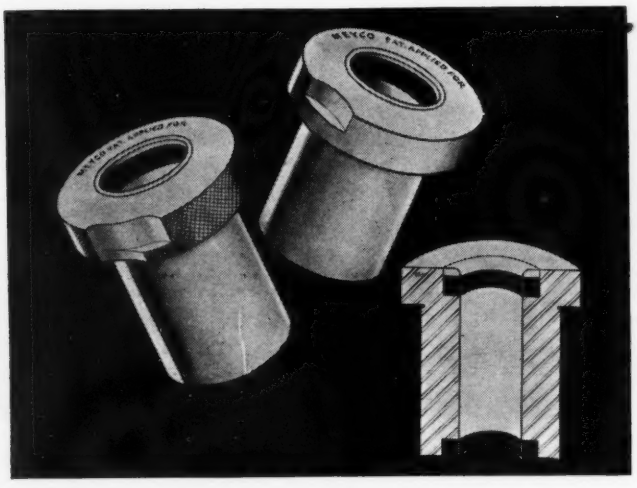
Threadwell Self-Oiling Ratchet Pipe-Threader

An improved pipe-threading tool so designed that the dies can be oiled during the threading operation is being placed on the market by the Threadwell Tap & Die Co., Greenfield, Mass. A full day's supply of oil is carried in the handle, and the dies can be lubricated simply by pressing a plunger at the end of the handle. This method of lubrication is said to increase the life of the dies as much as 150 per cent.

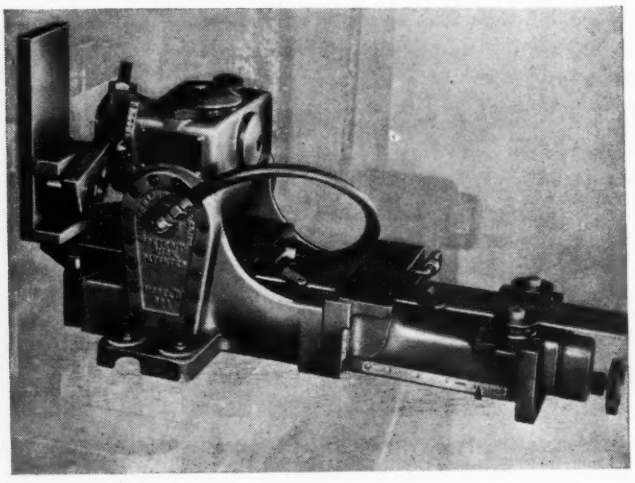
Other features of the new threading tool include the locating of the dies in direct line with the handle to minimize the cutting effort; special heat-treated tool-steel die with radial clearance for smooth operation; and a quick acting arrangement that permits fast change of die-heads.....106

Haller Punch Press Stock Feed

A hydraulically operated stock feed for use on punch presses having a stroke up to 6 inches has been announced by the Haller Machine & Mfg. Co., Inc., 7940 Tireman Ave., Detroit 4, Mich. This attachment handles stock up to 4 inches wide by 3/32 inch



Meyco Carbide-inserted Drill-jig Bushing

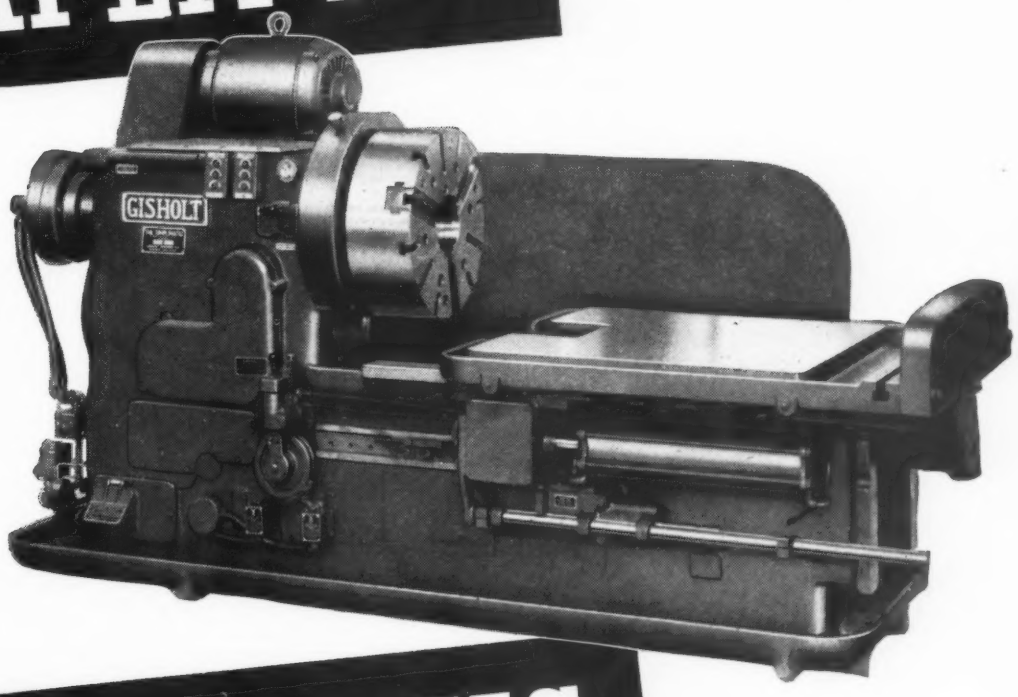


Haller Hydraulic Stock Feed for Punch Presses

To obtain additional information on equipment described on this page, see lower part of page 228.

SIMPLIFY

your "special" jobs with the GISHOLT



SIMPLIMATIC

Where you have sufficient volume for automatic machining, you, too, may find the low-cost answer in the Simplimatic.

For here's such adaptability in simple, basic design that it gives you an individualized machine to handle many diverse and unusual problems. Here are some of the reasons:

1. *A wide variety of slide positions is possible on the large platen table for straight and angular feeds.*
2. *Tailstock, hand or pneumatically operated, can be mounted on platen table for between-centers work.*
3. *Linkage arrangement between slides permits spherical boring in conjunction with facing and turning.*
4. *Back facing or back boring through the spindle can often be combined with other cuts in a single operation.*
5. *Vertical head can be used where it provides more favorable working position, with slides cammed individually or entire head cammed as a unit.*
6. *Simultaneous double end machining is possible with full utilization of the base machine.*

Now, with higher costs for labor and materials, investigate the economies the Simplimatic can bring you. Get the facts.

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts.*

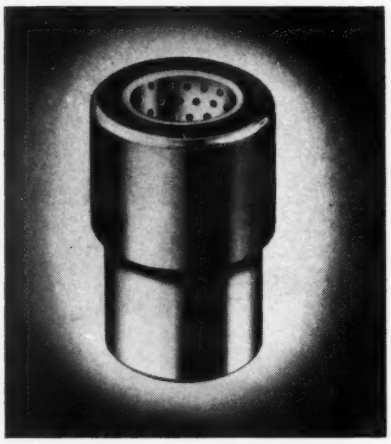
GISHOLT MACHINE COMPANY

Madison 3 • Wisconsin

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SUPERFINISHERS • SPECIAL MACHINES

thick, and feeds any desired length up to 5 inches on each stroke of the ram.

It is mounted on the bolster plate of the press, and can be located to feed from the left, right, front, or back of the machine. It has sufficient power to pull the stock through a roll type straightener, and can readily be removed from one press and used on another when desired. This stock-feeding attachment is 20 inches long, 10 1/2 inches wide, 10 1/4 inches high, and weighs 58 pounds. 107

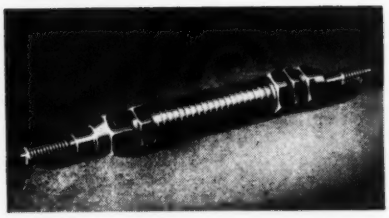


Indium-bronze Guide-pin Bushing for Die Sets, Developed by Standard Machinery Co.

Indium-Bronze Guide-Pin Bushings for Die Sets

Bushings consisting of a hard steel body and special bronze bearing liner electrolytically alloyed with indium have been developed by the Standard Machinery Co., Providence, R. I., to increase the accurate life of standard die sets. The non-ferrous bearing surface, together with indented spherical oil pockets, minimizes friction and eliminates scuffing and scoring.

The liner is formed from a special bearing bronze rolled to a precision gage and installed in the bushing under pressure. It is sized by a burnishing operation that keeps it in close contact with the bushing and corrects the inside diameter for a precision fit with the guide pin. The basic steel bushing is hardened and ground on both the inner and outer surfaces. These indium-bronze bushings are available in seven sizes with inside diameters ranging from 1 to 3 inches.....108



Flexible Metal Handles for Small Thread Gages

All-Metal Flexible Handles for Small Thread Gages

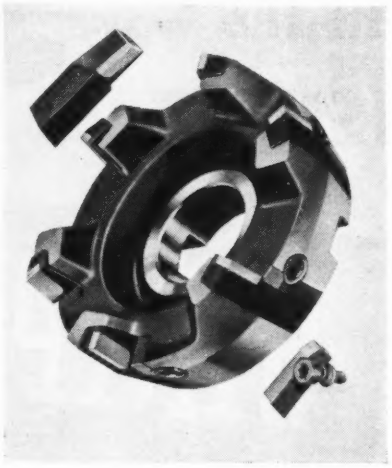
Light-weight, flexible all-metal handles for small-diameter thread gages up to the No. 10 machine screw size have been placed on the market by Lincoln Park Industries, 1719 Ferris Ave., Lincoln Park 25, Mich. These handles, originally designed for carbide wire type plug gages, provide flexibility which results in reduced pressure on the gage member and hence less danger of breakage from rough handling. They are of the collet type, made of metal throughout, and are unaffected by oils. 109

Leach Surface Grinder

A 6- by 12-inch surface grinder that is adapted for a large variety of work has been developed by the H. Leach Machinery Co., 387 Charles St., Providence 4, R. I. The new grinder is a self-contained unit with a two-speed ball-bearing spindle that can be operated either at 2750 or 3500 R.P.M. It is connected by a V-belt to a 3/4-H.P. motor, and is completely equipped with dust guards.

The spindle is mounted in precision type ball bearings, and the table and saddle feed-shafts are supported in permanent Oilite bearings. The vertical feed-screw also is ball-bearing mounted. The vertical slide has a travel of 10 1/2 inches, and the saddle a travel of 7 inches. The machine is of ribbed cast-iron construction, and is mounted on a box type welded steel base. 110

Surface Grinder Made by the H. Leach Machinery Co.



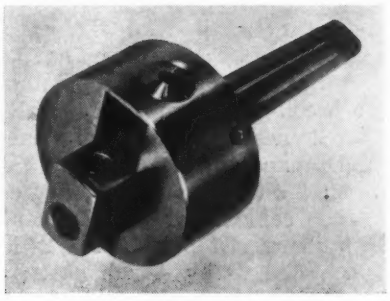
Gairing E-Con-O-Mill

Gairing Cone Type Face Mill

A new series of carbide cone type face mills having interchangeable cutters and standard locks has been developed by the Gairing Tool Co., 21225 Hoover Road, Detroit, Mich. These cutters, known as "E-Con-O-Mills," range from 5 to 16 inches in diameter, and are designed with from four blades for the smallest size up to twenty blades for the largest size.

The cone type bodies give full support to the blades and provide unobstructed chip clearance. The blades, which are of the square tool-bit type, 5/8 inch square, and tungsten-carbide tipped, are furnished with all clearance angles ground to a gage. They are made in three types, with different radial rakes for steel, cast iron, and non-ferrous materials. 111

To obtain additional information on equipment described on this page, see lower part of page 228.



Improved Boring Head Made by Flynn Mfg. Co.

Flynn Improved Boring Head

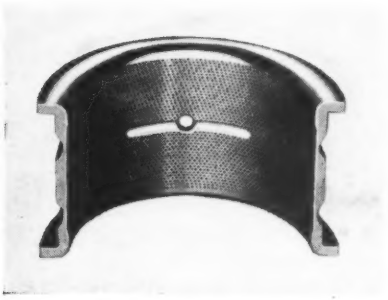
The Flynn Mfg. Co., 433 Bates St., Detroit 26, Mich., has redesigned its No. 12 offset boring head, giving the body a more compact form and extending the tool-block nose beyond the body. This change allows the tool to be used on recessed parts and work that is hard to reach. Other advantages of the improved boring head include greater thickness of the tool-grip side walls, increased length of the tool grip, and an increase in the ground bearing surfaces at two points; smoother operation; and greater rigidity.

The improvements include a more easily read dial on the micrometer adjusting screw, and a lock tension screw which relieves the strain on the hardened and ground micrometer screw when handling heavy work. 112

High-Speed Heavy-Duty Gridded Bearing

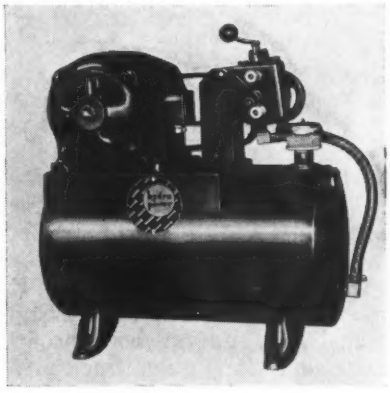
The National Bearing Division, American Brake Shoe Co., St. Louis 10, Mo., has developed an improved high-speed heavy-duty gridded bearing to meet the requirements for connecting-rods of heavily loaded, heavy-duty Diesel engines and machinery having similar operating requirements. The new bearing is available in the half-bushing form or full cylindrical bearing types. These bearings are operating under loads of 3500 pounds per square inch, projected area, with shafts as low as 160 Brinell hardness.

A centrifugally cast lead-tin-bronze bearing with grids, such as illustrated, serves to combine the strength and high thermal conductivity of the bronze with the



Gridded Bearing for High-speed Heavy-duty Service

desirable qualities of the babbitt which fills the grid spaces. In periods of overstress, some of the babbitt melts and forms a lining that prevents "seizing." 113



Hydraulic Power Unit Made by Hydro-Power, Inc.

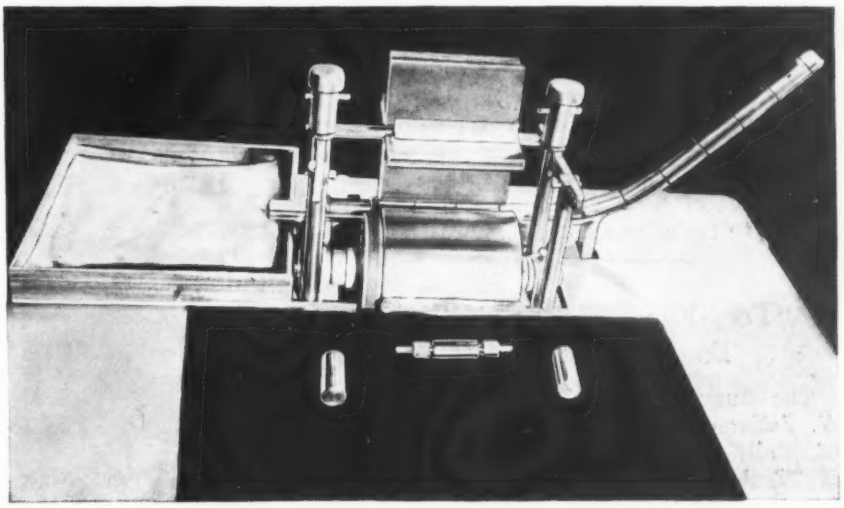
Portable Hydraulic Power Unit

A portable hydraulic power unit capable of pumping three gallons of fluid per minute at 1000 pounds per square inch pressure is being produced by Hydro-Power, Inc., Belmont and Sheridan Aves., Springfield, Ohio. The new unit can be easily applied to the operation of such equipment as hydraulic wheel-pullers, shaft extractors, arbor presses, broaching tools, pipe benders, and vises.

It consists of a seventeen-gallon storage tank with foot mountings, an electric motor, a V-belt connected gear pump, and a four-way operating valve. Weighing approximately 290 pounds when supplied with operating oil, the assembly occupies a space 16 1/8 inches wide by 28 inches long by 29 inches high. The unit can be mounted on centers or placed on a hand truck. It is normally supplied with a 1 1/2-H.P., 1800-R.P.M., 220- or 440-volt motor, but can be used with a 2 1/2-H.P., 1200-R.P.M., air-cooled gasoline motor for out-of-door service. 114

Automatic Feed Attachment for Centerless Lapper

Higher production and a more uniform product are said to result from the application of a new automatic feed attachment to the centerless lapping machine made by the Size Control Co., Division of American Gage & Machine Co., 2500 Washington Blvd., Chicago, Ill. With this device, feeding, holding, and ejecting are accomplished automatically. The operator, after adjusting the tension on the holding applicator, merely has to keep the feed chute loaded with work pieces. Cylin-



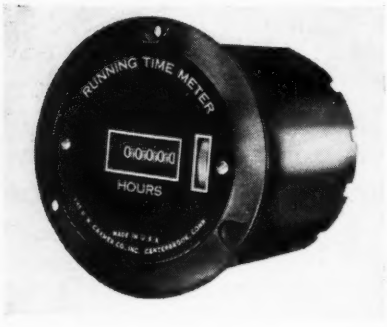
Automatic Feed Attachment for Centerless Lapping Machine, Designed by the Size Control Co.

To obtain additional information on equipment described on this page, see lower part of page 228.

drical pieces are fed in between the lapping rolls, lapped to a precision finish of less than 2 micro inches r.m.s., and ejected at the opposite end. A spring tension on the holding applicator permits adjusting the pressure applied to the work. 115

Cramer Operation Timing Meter

The R. W. Cramer Co., Inc., Centerbrook, Conn., is manufacturing a new "Time Totalizer" or running-time meter with a counter that can be reset to zero. It is designed for use on alternating-current circuits, and will automatically register the total operating or idle time of any circuit,



"Time Totalizer" Operation Timing Meter

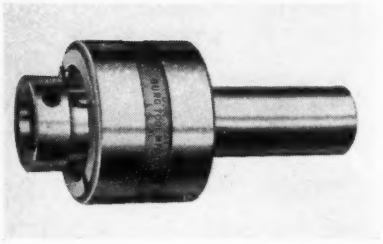
machine, or system to which it is connected.

Typical applications include indication of operating time of vacuum tubes, so that replacements can be made before failure occurs; indication of total operation hours of automatic pumps and machines, forecasting need of servicing and parts replacement; and checking operating hours of equipment or material tested in laboratories.

The five-digit revolution type counter indicates in tenths up to 10,000 hours and then repeats. It is made of especially developed metals to resist wear. 116

"Tool-Flex" Floating Tool-Holders

The Burg Tool Mfg. Co., 5028 W. Jefferson Blvd., Los Angeles 16, Calif., has added to its line of "Tool-Flex" holders a pull-out type floating tool-holder designed to increase the efficiency of tapping operations on screw ma-

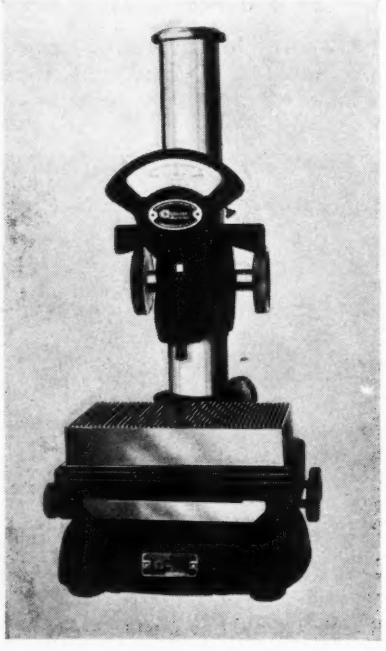


Tool-Flex Holder for Tapping Operations on Screw Machines

chines. A neoprene mounting keeps the taps on center and permits them to follow the original hole, thus preventing misalignment and assuring accurate threads. The short overhang on the smaller types of these holders is said to make them especially suitable for small clearance machines. 117

Production Measuring Comparator

Provision for five interchangeable tables and the use of standard indicators are features of a comparator recently developed by the Standard Gage Co., Inc., Poughkeepsie, N. Y., for both production and inspection measuring jobs. Raising, lowering, and approximate positioning of the indicator support arm are facilitated by a rack on the rear of the column. A fine adjustment for



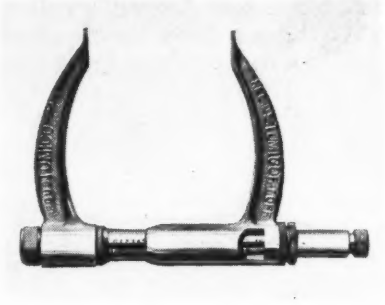
Comparator Made by the Standard Gage Co.

setting the comparator to a standard is effected by a wing handle. Pressure of the contact point on the work-piece can be regulated by a knurled bushing, and a reed mechanism within the head prevents side thrust on the indicator.

The comparator is available with serrated tables in 1 1/2- by 4-inch and 6- by 4-inch sizes; a 1 1/2- by 4-inch plain table; and a table having 1 1/2-inch diameter rolls for checking lobal conditions. 118

Crankshaft Micrometers

A direct-reading crankshaft micrometer that makes possible the measurement of journal diam-



Tumico Direct-reading Crankshaft Micrometer

eters without removing the crankshaft from the engine block is a recent development of the Tubular Micrometer Co., St. James, Minn. Although primarily designed for combustion engines, it can also be used on compressors, pumps, and similar equipment employing an eccentric power motion. An accuracy of 0.001 inch is obtained by the use of a precision micrometer screw having a ground-from-solid thread that is lapped to a companion bushing. The capacity of the micrometer is from 2 to 3 inches, English measure, or 50 to 75 millimeters, metric measure.

Standard sets consist of the micrometer, case, adjusting wrench, and checking standard. 119

Westinghouse Carbon-Arc Torch

A Flexarc carbon-arc torch has been developed by the Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa., for

To obtain additional information on equipment described on this page, see lower part of page 228.

NOW! Easy to order STANDARDS

—for 60% to 80% of your machining!

THIS new Carboloy Cemented Carbide Catalog lists *over 600 standard low-cost blanks, tools, wear parts and specialties!*

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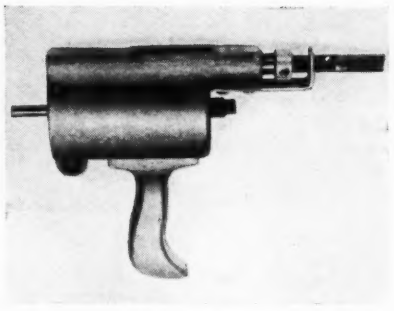
brazing, soldering, and supplying heat for light forging and preheating before welding operations. Each torch is supplied with two 10-foot extra flexible welding cable leads; one pair of 1/4- by 6-inch carbon electrodes; and one pair of 3/8- by 6-inch carbon electrodes. The leads are equipped with bayonet attachment plugs to fit the WT Midget Marvel and limited input welders. 120

One of a New Line of Kern Alternating-current Portable Welders

Kern Portable Alternating-Current Welders

Three industrial welders in capacities of 200, 300, and 400 amperes, and two welders for general shop applications having capacities of 130 and 180 amperes, have been designed by the John A. Kern Co., 224 (43) N. Loomis St., Chicago 7, Ill. These welders are of unusually compact design, the movable cores traveling less than 1 inch to cover the entire range of stepless amperage control. The arrangement of dual primary and secondary coils and the elimination of arc boosters, regulator coils, and fans also contribute to the compactness of the design.

Cooling is obtained by providing an air passage around the coils and cores. The air intake at the bottom of the housing is about 1 foot above the floor, thereby eliminating the chances of dust and dirt restricting the passage. The carriages are welded steel tubing and are equipped with cast-aluminum wheels. 121



Saw and File Attachment for Hand Drills or Drill Presses

Whittle Portable Attachments for Drills

The J. D. Whittle Co., 208 N. Wells St., Chicago 6, Ill., is offering to the trade four interchangeable attachments for portable hand drills and drill presses that can be used to sand, drive screws, polish, grind, file, and saw steel, plastic, or wood.

The units include a saw and file attachment for a hand drill; a 3-inch disk sander for any electric hand drill or drill press; a saw and file attachment for electric hand drills and drill presses; and a screwdriver attachment that will accommodate socket bits and Phillips screwdriver bits. 122

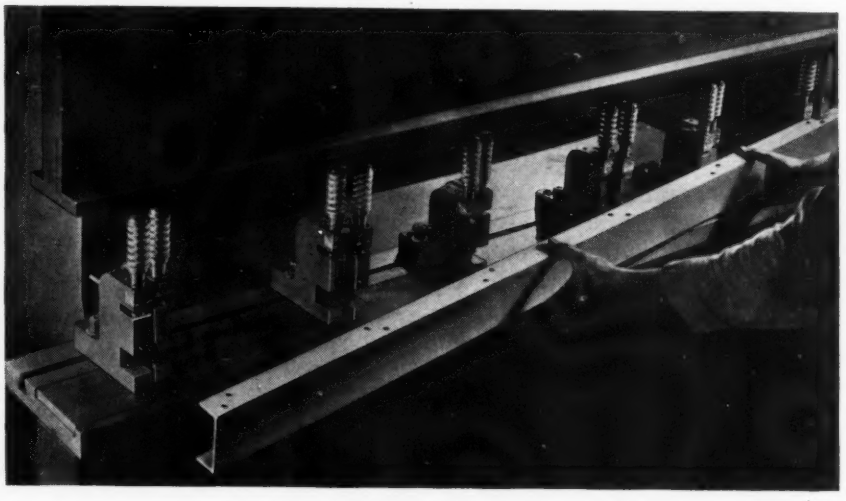
Two-Stage Synclinal Filter with Special Wire Housing

A new model synclinal oil filter for hydraulic equipment and machine tools is being produced by the Marvel Engineering Co., 629 W. Washington Blvd., Chicago 6, Ill. In this model, the filters are enclosed in a special non-rusting eight-mesh wire screen that acts both as a frame-work to contain the filtering insert and as a primary screening stage to prevent coarse particles from touching the filtering cloth. This "pre-straining" is said to permit longer and more effective use of the filter before cleaning becomes necessary; in conjunction with the corrugated synclinal design, it also allows a high rate of fluid flow under less pressure. 123

Synclinal Filter with New Wire Screen Housing

Wales Hole-Punching Unit

The Wales-Strippit Corporation, 345 Payne Ave., North Tonawanda, N. Y., has announced a



Wales-Strippit Heavy-duty Type Punching Unit

To obtain additional information on equipment described on this page, see lower part of page 228.

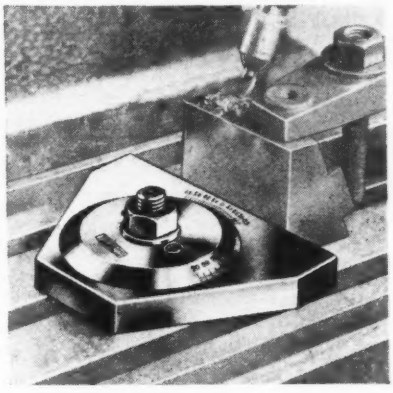
new heavy-duty Type EJ hole-punching unit which has a center projecting member for carrying the die members. This feature eliminates one of the hole-punching problems encountered in sheet-metal fabrication work, permitting a series of holes to be punched simultaneously in angles, channels, and extruded shapes. The center projections can be easily adapted for punching the various extruded sections.

The hole-punching units are independent and self-contained. They require no fastening or attachment to the press ram, which functions only as a means for depressing the punch members. All operating parts, including the punch, guide, stripping spring, and die, are built in or assembled in the holder, which serves to automatically align the punch and die members. On the down stroke of the ram, the stripping spring is compressed, and on the up stroke it expands, stripping the punch from the work. 124

Taft-Peirce Machine Table Protractor for Angular Work

A machine table protractor that insures fast accurate angular location on milling machine or other machine tables has been designed by the Taft-Peirce Mfg. Co., Woonsocket, R. I. The graduated index-plate has a vernier scale for making settings to within 5 minutes of the desired angle.

The tool is constructed of hardened steel parts. It is designed to accommodate standard size tongues to fit conventional T-slots, but can be supplied to suit special slot requirements...125



Taft-Peirce Machine Table Protractor

Fig. 1. Vickers Hydraulic Variable-speed Transmission

Fig. 2. Vickers Hydraulic Traverse and Feed Cycle Control Panel

Vickers Hydraulic-Power Equipment

Vickers, Inc., 1400 Oakman Boulevard, Detroit 32, Mich., is building hydraulic variable-speed transmissions, such as shown in Fig. 1, for fractional-horsepower machinery drives. The new unit has stepless adjustment of the output speed from zero to maximum in either direction of rotation and with constant-torque power characteristics throughout the entire range.

Another new Vickers product is the traverse and feed-cycle control panel for machine tool applications (Fig. 2). This control is adapted for use on drilling, reaming, boring, turning, milling, and swaging machines. 126

Acro Sequence Control for Aluminum Spot-Welding

The Acro Welder Mfg. Co., 1825 W. St. Paul Ave., Milwaukee 3, Wis., has developed a new sequence control unit, by means of which ordinary resistance welders can be adapted for the production of high-strength spot-welds in sheet aluminum and most nonferrous metals. This new unit has innumerable applications in the mass production of automotive parts, sheet-metal assemblies, and a variety of metal products. It can be easily installed and operated in conjunction with standard transformer type alternating-current air-operated welding machines, timers, and contactors.

This control is available in two sizes which cover the entire range of air-operated spot-welders. The Model AP-45 can be used with machines having capacities up to 100 KVA, while the Model AP-65 is built for machines with capacities above 100 KVA.

A toggle-switch arrangement enables the welder to be instantly adapted for regular welding.....127

Walker Magnetic Swivel Chuck

A chuck that provides a magnetic surface over and around corners is being produced by the O. S. Walker Co., Inc., Worcester, Mass. Heretofore such chucks were limited in holding power up to a given point from the corners of the two faces of the chuck.

This unit, known as the Walker apex swivel chuck, is said to have a 100 per cent magnetic surface, thus enabling the user to hold small, narrow strips, such as knives, to the very edge. Another advantageous feature of the chuck is that it is impervious to moisture leakage. 128

Acro Sequence Control for Spot-welding Aluminum

To obtain additional information on equipment described on this page, see lower part of page 228.

Special Carbide-tipped Drill Made by Super Tool Co.

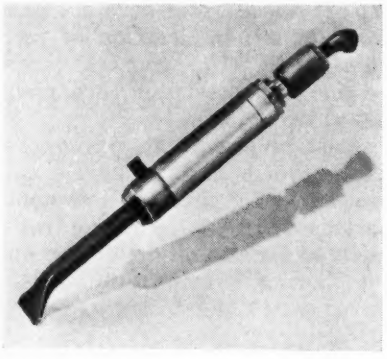
Carbide-Tipped Drill for Hardened Steel

For the benefit of shops that frequently find it necessary to drill holes in dies, fixtures, or other production equipment after the metal has been hardened, the Super Tool Co., 21650 Hoover Road, Detroit, Mich., has designed a new line of standard carbide-tipped drills. The new drills are available in ten sizes for drilling holes ranging from 3/16 to 3/4 inch in diameter. They can be used either dry or with a coolant. 129

Rotor Scaling Hammer

A scaling hammer designed for peening, chipping, star-drilling, and removing rust, sand, or scale from metal surfaces has been announced by the Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio. This tool can be adjusted to vary the number of blows delivered in accordance with the type of work being handled.

The chisel retainer is so designed that the chisel can be removed by thumb pressure. A square broached hole in the nose eliminates the bushing ordinarily used in tools of this type, and guides the chisel at all times. These tools are furnished in blank form or in platform and spoon form, and a full line of star drills is available in sizes from 3/16 to 3/4 inch. The hammer weighs 3 pounds, and is 10 1/4 inches long without the chisel. 130



Scaling Hammer for Production Line and Maintenance Work Made by Rotor Tool Co.

American Optical Co.'s New Safety Goggle

A safety goggle that can be worn directly over the eyes or over spectacles for protection against flying particles is being made available to the trade by the American Optical Co., Southbridge, Mass.

This new light-weight goggle has an all-plastic frame with a single plastic acetate lens in green or white. The lens is replaceable, and the metal temples, enclosed in acetate to prevent corrosion, can be adjusted to hold the goggles snugly. The design of the frame is such as to provide unobstructed side vision and excellent frontal protection. 131

All-plastic Safety Goggle Made by American Optical Co.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in January, 1948, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 234 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January, 1948, Number of MACHINERY

Wear and Surface Finish

GISHOLT MACHINE CO., Madison 3, Wis. 80-page text-book covering the basic reasons for surface wear and its relation to surface finishing. Data is included on the measurement of surface roughness and its correction by Superfinishing. Copies can be obtained without charge if requested on a company letter-head and addressed directly to the Gisholt Machine Co.

Ball Bearings

FEDERAL BEARINGS CO., INC., Poughkeepsie, N. Y. Catalogue K, containing 260 pages of data on Federal anti-friction bearings, interchangeability and conversion tables, and engineering information. Copies can be obtained if requested on a letter-head addressed to the Federal Bearings Co.

Tracer-Controlled Milling Machines

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 495, describing various sizes of Keller Type BG tracer-controlled milling machines, and showing typical examples of work. Circular 501, illustrating and describing the latest Keller Type BG-22 tracer-controlled milling machine, with advanced features of design and control. 1

Maintenance and Production Welding

EUTECTIC WELDING ALLOYS CORPORATION, 40 Worth St., New York 13, N. Y. Bulletin entitled "Arc Welding Problems Successfully Solved," containing twelve production case histories on welding jobs. Bulletin entitled "Another Major Advance in Gas Welding," describing applications of various new flux-coated alloys known as "EutecRods" for steel, cast iron, brass, and aluminum...2

Screw Calculator

STANDARD PRESSED STEEL CO., Box 22, Jenkintown, Pa. Handy slide-rule device for determining comparative dimensions of knurled socket-head cap-screws, hollow set-screws, shoulder screws, and cup-point and self-locking set-screws. The number of threads per inch, head sizes, and other dimensions for screws of various diameters can be quickly determined.....3

Electric Heat-Treating Furnaces

COOLEY ELECTRIC MFG. CORPORATION, 44 S. Shelby St., Indianapolis 7, Ind. Bulletins 70 to 75, inclusive, containing information on the design features and the application of Cooley electric furnaces for different classes of work. Instructions on selecting the right type of furnace for various requirements are included. 4

Transmission Equipment

FALK CORPORATION, 3001 W. Canal St., Milwaukee 8, Wis. Bulletin 10,000, containing condensed data covering all Falk precision products, which include gears, speed reducers, couplings, high-speed drives, marine drives, special gear drives, etc. Services offered by the company, such as steel casting, machining weldments, and engineering are also outlined. 5

Mechanical Converters

LEO G. BROWN ENGINEERING CO., 1127 Riverside Drive, Los Angeles 31, Calif. Circular descriptive of the Brown line of mechanical converters for changing vertical or horizontal rotating motion to reciprocating motion; made in styles applicable to drill presses and milling machines, and in an all-electric portable type.....6

Multiple-Spindle Drilling, Boring, and Tapping Machines

NATIONAL AUTOMATIC TOOL CO., INC., Department 40, Richmond, Ind. Bulletin containing sixty-six case histories of various parts machined on Natco drilling, boring, facing, and tapping machines. Complete information on each job is given, including production, limits, and material employed.....7

Contour Sawing Handbook

DOALL CO., 254 N. Laurel Ave., Des Plains, Ill. "Contour Sawing Handbook" (Twelfth Edition) containing special information on band-sawing procedures, as well as complete instruction programs for use in a shop or school training course. A wide range of applications of contour sawing and filing machines is illustrated and described. 8

Arc-Welders

HOBART BROTHERS CO., Troy, Ohio. Catalogue containing complete specifications, illustrations, and descriptions covering the Hobart "Simplified" line of arc-welders, including both direct-current and alternating-current welders and generators; also includes data on Hobart arc-welding electrodes and accessories.....9

Worm-Gearing Data

DE LAVAL STEAM TURBINE CO., Trenton 2, N. J. Bulletin WG 1220-5-46, illustrating and describing the advantages of worm-

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faster, more accurately, at lower cost

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SHAPER

a gear shaper, a contour former,
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gearing, and including data on bearing load formulas; quality control and precision manufacturing; selection practice; horsepower ratings, and other technical data. 10

Welding Electrodes and Alloys

WEIGER WEED & CO., DIVISION OF FANSTEEL METALLURGICAL CORPORATION, 11644 Cloverdale Ave., Detroit 4, Mich. Booklet W-102, containing data on resistance welding electrodes, tips, water-cooled holders, and refractory alloys. Recommended welding practices are included. 11

Hydraulic Die-Casting Machine

CLEVELAND AUTOMATIC MACHINE CO., 4936 Beech St., Cincinnati 12, Ohio. Circular containing complete specifications covering the new Cleveland Model 200 universal high-pressure hydraulic die-casting machine for zinc, tin, or lead. 12

Circular Sawing Machines

MOTCH & MERRYWEATHER MACHINERY CO., Penton Building, Cleveland 13, Ohio. Catalogues descriptive of the four basic Motch & Merryweather circular sawing machines equipped with triple-chip saw blades and automatic sharpeners, for cutting stock from 1/4 to 16 1/2 inches. 13

Cutting Fluids

D. A. STUART STEEL CO., LTD., 2739 S. Troy St., Chicago 23, Ill. Revised booklet entitled "Cutting Fluids for Better Machining," containing seventy-two pages covering the application of oils for cutting, grinding, drawing, quenching, tempering, and other metal-working operations. 14

Hard-Facing Metal

FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill. Bulletin F-633, descriptive of "Fanweld," a non-ferrous hard-facing alloy containing tantalum-columbium carbide, which imparts a low coefficient of friction to the metal.....15

Selecting an Air Compressor

PNEUMATIC AUTOMOTIVE EQUIPMENT ASSOCIATION, 1108 Clark Bldg., Pittsburgh 22, Pa. Bulletin containing complete information compiled to enable the right size and type of air compressor to be selected for any application; the data covers both automotive and industrial air compressors.....16

Automatic Machines

NEW BRITAIN MACHINE CO., NEW BRITAIN-GRIDLEY MACHINE DIVISION, New Britain, Conn. Catalogue illustrating and describing the company's line of automatic machinery, including screw machines, chucking machines, precision boring machines, and automatic turret lathes. 17

Welding Rods and Electrodes

AMERICAN MANGANESE STEEL DIVISION, AMERICAN BRAKE SHOE CO., Chicago Heights, Ill. Bulletin 947-W, describing the application of Amsco "Toolface" high-speed steel welding rods and electrodes to the production or salvaging of cutting tools and dies. 18

Magnetic Plugs for Removing Iron and Steel

LISLE CORPORATION, Clarinda, Iowa. Circular entitled "From the Blue Book of American Industry," showing various applications of the Lisle magnetic plug for removing abrasive iron and steel particles from lubricants used on moving parts. 19

Metal Cutting and Forming Tools

C-B TOOL CO., Lancaster, Pa. Leaflet illustrating the C-B Royal Clipper metal cutter applicable to sheet metal, fiber board, and other light sheet material, and the C-B manual metal shrinker or stretcher for forming angles in metal parts. 20

Dust and Fume Eliminators

SCHMIEG INDUSTRIES, INC., 300 Piquette Ave., Detroit 2, Mich. Catalogue descriptive of the Schmieg swirl type "Centri-Merge" dust and fume eliminators for grinding operations or any other industrial applications where dust- or fume-laden air is encountered.....21

Electric Drives

ROBBINS & MYERS, INC., Springfield, Ohio. Circular entitled, "Facts About R & M Drives," containing information on electric motor drives for machine tools. Bulletin giving data on various types and sizes of alternating- and direct-current motors. 22

Combination Boring and Reaming Tool

ERICKSON TOOLS DIVISION OF THE ERICKSON STEEL CO., 2306 Hamilton Ave., Cleveland 14, Ohio. Circular describing the "State" adjustable combination boring and reaming tool and the "State" adjustable core drill.....23

Hydraulic Slotting Machines

ROCKFORD MACHINE TOOL CO., Rockford, Ill. Bulletin 460, describing the design, construction, and application of the Rockford new 36- and 48-inch "Hy-Draulic" slotters; includes dimensional diagrams and data on speeds and feeds.....24

Induction Furnaces

AJAX ELECTROTHERMIC CORPORATION, Ajax Park, Trenton 5, N. J. Bulletin 14-A, containing data on Ajax-Northrup 20- and 40-kilowatt induction furnaces of the converter type, designed for induction melting, heating, brazing, and hardening. 25

Temperature Checking Instrument

THOMAS A. EDISON, INC., Instrument Division, West Orange, N. J. Bulletin illustrating and describing the Edison critical temperature monitor, for automatically checking operating temperatures at selected locations...26

Equipment for the Metal Industries

ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis. Bulletin 25B6773, on equipment for the metal industries, including high-frequency converters for induction heating, radiography equipment, arc furnace transformers and control, and precision castings. 27

Belting Application

UNISPLICE BELTING CO., 1119 Wolfendale St., Pittsburgh 12, Pa. Reprint of an article entitled "A New Technique in Belting Application," presented before the American Society of Tool Engineers.....28

Lifting Tables

MONTGOMERY & CO., 53 Park Place, New York 7, N. Y. Circu-

lar illustrating two styles of "Di-Lifts", with capacities of 500 and 2000 pounds, respectively, for lifting dies, supporting overhanging work, loading trucks, and similar uses. 29

Centralized Lubricating System

FARVAL CORPORATION, 3293 E. 80th St., Cleveland 4, Ohio. Bulletin 15, describing the features of design of the Multival lubricating system for delivering lubricant under high pressure from a single grease-gun connection to several bearings in measured amounts. 30

Hydraulic Oil Handbook

E. F. HOUGHTON & Co., Philadelphia, Pa. 48-page handbook on hydraulic oils, describing the properties and giving complete specifications. A chapter is included on troubles frequently encountered with hydraulic oils and their remedies. 31

Flexible Power Presses

GENERAL MFG. CO., 6429 Farnsworth Ave., Detroit 11, Mich. Bulletin 392, illustrating and describing the company's line of flexible power presses for production straightening, bending, assembling, push broaching, and cold riveting. 32

Precision Ball Bearings

JACK & HEINTZ PRECISION INDUSTRIES, INC., Cleveland 1, Ohio. Catalogue 2001, on ball bearings giving dimensions, rated bearing loads, and other data. A pictorial section devoted to J & H precision ball-bearing production methods is included. 33

Indicating Recorders and Controllers

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia 44, Pa. Catalogue ND44(2), illustrating and describing Micromax Model R indicating recorders and controllers. Complete specifications are included. 34

Cemented-Carbide Wheel-Dressers

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Blvd., Detroit 32, Mich. Booklet DR-480, describing and illustrating the company's new line of diamond-impregnated cemented-carbide grinding-wheel dressers. 35

Oxygen Cutting of Steel

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Reprint of an article entitled "Oxygen Cutting of Steel at Elevated Temperatures"; includes data derived from over 3000 cutting tests. 36

Centerless Belt Grinding

PORTER - CABLE MACHINE CO., 1714 N. Salina St., Syracuse 8, N. Y. Folder descriptive of the Porter-Cable wet-or-dry belt centerless grinder designed for economical constant or intermittent duty. 37

Pneumatic Comparator Gages

MOORE PRODUCTS CO., H and Lycoming Sts., Philadelphia 24, Pa. Bulletin 804, describing the basic principles of Moore pneumatic comparator gages and their applications. Complete data on the various types of gages is included. 38

Hole-Punching Units

WALES - STRIPPIT CORPORATION, North Tonawanda, N. Y. Catalogue C, illustrating and describing Wales self-contained hole-punching units designed for punching rivet holes in sheets, angles, and extruded pieces.....39

Grinding Wheels

A. P. DE SANNO & SON, INC., Phoenixville, Pa. Catalogue 103, containing information on "Radiac" grinding wheels, with recommendations to aid in choosing the correct wheel for use in grinding different materials and types of work. 40

Machining Stainless Steels

AMERICAN ROLLING MILL CO., 703 Curtis St., Middletown, Ohio. 38-page booklet containing information on cutting rates, cutting fluids, and tool composition for machining various grades of Armco stainless steels. 41

Carbide Tools

MCGILL CARBIDE TOOL CO., 4612 Woodward Ave., Detroit 1, Mich. Catalogue 107, covering the various types of tungsten-carbide tipped tools made by the company, both in standard sizes and for special applications. 42

Swivel-Base Quick-Acting Bench Vise

HARTMANN MFG. CO., 1600 Junction Ave., Racine, Wis. Circular illustrating and describing the new Hartmann 4 1/2-inch swivel-base bench vise with direct lever clamping action. 43

New Trade Literature Concluded on page 238

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation) fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (January, 1948) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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BETWEEN GRINDS

Sin of Sinclair?

Writer Sinclair Lewis evidently never poked around the machine shops on Main Street, for in his book "Kingsblood Royal," he gives his hero the novel hobby of cutting out jig-saw puzzles on a *lathe*. If this can be done, Mr. Lewis, maybe you would explain it to our readers in the "Ingenious Mechanisms" columns.

Is That Car Coming or Going?

Since the revolutionary style Studebaker has been the subject of wide-spread comment and occasional jokes (?), George E. Westphal, general factory superintendent of the Studebaker Corporation, confines his leading article in this issue to descriptions of outstanding operations employed in producing the popular "Champion" and "Commander" models. Transfer type milling and drilling, induction hardening, and multiple-spindle grinding are among the high-production processes discussed. Incidentally, the "merry-go-round" referred to in the article is not the kind that will make you dizzy for a dime.

Man of Industry

Author of our newest monthly feature, a page on the problems of the sales engineer, is Bernard Lester, assistant industrial sales manager (headquarters), Westinghouse Electric Corporation. As he is known to sundry, "Barney" has led an active, fruitful life, chock-full of college degrees, memberships in societies and clubs, assignments as lecturer at various universities, and literary achievements (books on business principles for technical men and numerous articles on engineering and marketing topics). Last but not least, his consistant affiliation with Westinghouse since 1905, has been studded with promotions and, in 1941, he was awarded the Westinghouse Order of Merit. Over the luncheon table he confided that he's an enthusiastic golfer, a commuter (not so), and a Quaker. He evidently handles the problem of time in much the same efficient productive way as he will the interesting problems on his page in MACHINERY this coming year.

So We Did

One of our inquirers for information was somewhat upset by the variety of answers he had been receiving to his query—from other magazines, of course! Accordingly, he ended his letter to us in emphatic caps: So Will You Please Tell Me Right?

Clippings to Newcastle

At the request of an Australian manufacturer of wire products in Newcastle, New South Wales, we sent six tear sheets of an article "Lubrication Considerations in Gear Design" which appeared in May, 1947, MACHINERY, and received this acknowledgement: "Please accept our thanks for sending the above as requested, and we do appreciate your action in forwarding them free of cost to us. We consider the article to be a very fine effort and it will be of great value to our designers and plant engineers."

Now, in January MACHINERY, we are presenting a companion-piece entitled "Lubrication Factors in Bearing Design," in which you should also be interested, Down Under. A long-ranger with an eye focussed on designers in both hemispheres wrote this too.

How To Make Friends

Our roving editor has a new technique for becoming acquainted with important business men, which, while hazardous, proved effective in this instance. On his recent trip to Hot Springs to attend the NMTBA convention, he started to shave in the crowded washroom on the train. A defective seam in his tube of shaving cream gave way and the cream shot out like an arrow into the air and landed in the lap of a stranger eight feet away. Profuse apologies followed. The next evening found the editor looking straight into the eyes of the stranger across the banquet table, who was identified as the vice-president of a prominent New England company. The feeling of having met before led tc camaraderie during the dinner and the remainder of their stay in Virginia.

Call Me Mister

The form which is always handed to a man who has signified his desire to join the ranks of MACHINERY'S readers carries a space under "Title" for writing in his official status where he is employed. One of these cards just reached us with a single word meekly inserted on that line—"Mr."

Quiz Espagnol

You live in Madrid and wish to subscribe to MACHINERY for one year. How much do you pay? Two hundred pesetas does it, senor. *E. S. S.*

Metallizing Spray Gun

VANDE MFG. CO., 1837 S Michigan Ave., Chicago 16, Ill. Circular descriptive of the Vande metallizing gun of new design, for applying such metals as steel, aluminum, zinc, lead, bronze, copper, nickel, etc. 44

Expansion Push-Broaches

EAST SHORE MACHINE PRODUCTS CO., 835 E. 140th St., Cleveland 10, Ohio. Bulletin 10, containing data on the Glenny adjustable expansion push-broach designed for rapid and accurate keyway cutting. 45

Protective Coating

GLOBE IMPERIAL CORPORATION, 2025 Kishwaukee St., Rockford, Ill. Catalogue on "Plastic-Seal" coating for protecting cutting tools, bearings, gages, and other highly finished parts during storage or shipment. 46

Rubber Roller Polishing Machine

R. K. LEBLOND MACHINE TOOL CO., Cincinnati 8, Ohio. Folder describing a 19-inch Regal lathe specially equipped for grinding and polishing rubber rolls. 47

Carbide Metal Tools

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa. Methods Manual for Carmet carbide metal tools, covering grades, speeds, feeds, cuts, and suggestions for setting up. 48

Thermo-Couples and Pyrometer Accessories

BRISTOL CO., Waterbury 91, Conn. Bulletin P1235, containing engineering data on thermocouples, protection tubes, and pyrometer accessories. 49

Machine Tools

MILES MACHINERY CO., Saginaw, Mich. Catalogue describing the machine tool rebuilding service offered by the company, and listing various machine tools, new and old, now available.....50

Photograph Paper for Reproducing Drawings

EASTMAN KODAK CO., 343 State St., Rochester 4, N. Y. Pamphlet descriptive of a new photograph paper for reproducing engineering drawings. 51

Power Presses

E. W. BLISS CO., 444 Amsterdam, Detroit 2, Mich. Folder entitled "New Pages in the Bliss Book of Advanced Press Design," describing some power presses recently completed. 52

Slitting Saw Blades for Milling

MOTCH & MERRYWEATHER MACHINERY CO., Penton Bldg., Cleveland 13, Ohio. Folder containing data on a line of slitting saw blades and adapters for milling operations. 53

Hydraulic Cylinders

MILLER MOTOR CO., 4027-33 N. Kedzie Ave., Chicago 18, Ill. Bulletin H-104, containing complete mounting dimensions for double-acting and single-acting high-pressure hydraulic cylinders.....54

Midget Milling Cutters

SEVERANCE TOOL INDUSTRIES, INC., 636 Iowa St., Saginaw Mich. Bulletin 16-M, listing the company's full line of high-speed steel and carbide midget milling cutters, and ground carbide files...55

Aluminum Casting Alloys

ACME ALUMINUM ALLOYS, INC., Dayton, Ohio. Pamphlets containing technical data on two high-tensile aluminum casting alloys, known as Acme Almag 35 and Acme Almag 55. 56

Rotary Files

CHARLES L. JARVIS CO., Middletown, Conn. Catalogue RF 101, containing twelve pages illustrating more than one hundred high-speed steel and carbide rotary files in actual size. 57

Gear Chucks

GARRISON MACHINE WORKS, INC., 515 Bannock St., Dayton 4, Ohio. Two folders describing draw bar - operated bevel - gear chucks and pitch-line control gear chucks.....58

Carbide-Tipped Tools

SCHMARJE TOOL & ENGINEERING CO., Muscatine, Iowa. Catalogue 147, listing precision diamond-lapped carbide-tipped reamers, spot-facers, and centers.....59

Steel Shelving

PRECISION EQUIPMENT CO., 2658 N. Long Ave., Chicago 39, Ill. Circular listing interchangeable steel shelving in a variety of sizes, available for prompt delivery.....60

Shapers

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit 12, Mich. Technical bulletin 1800-47, describing the company's line of Shear-Speed shapers and their uses. 61

Industrial Motion Pictures

WESTINGHOUSE ELECTRIC CORPORATION, Film Section, P. O. Box 868, Pittsburgh 30, Pa. Booklet B-3988, listing industrial sound motion pictures and slide films...62

Lift Hooks

JOHNSTON & JENNINGS CO., FORGE AND MACHINE DIVISION, Cleveland 14, Ohio. Circular giving standard sizes of the new J & J lift hook for handling dies and other heavy objects. 63

Saw Blade Selection and Use

VICTOR SAW WORKS, INC., Middletown, Conn. 17- by 22-inch wall chart, showing the proper hand, band, or power saw blade to use for various metals. 64

Welding Stainless Steels

ARCOS CORPORATION, 1515 Locust St., Philadelphia 2, Pa. Bulletin 1047, entitled "What Electrode to Use to Weld a Specified Stainless or Alloy Steel." 65

Hardness Testers

AMES PRECISION MACHINE WORKS, Waltham 54, Mass. Catalogue describing Ames portable hardness testers reading directly in Rockwell scales. 66

Motors for Built-In Drives

LOUIS ALLIS CO., Milwaukee 7, Wis. Bulletin 516-D, describing Type CT rolled-shell, shaftless, squirrel-cage induction motors for built-in drives. 67

Plain Hydraulic Grinder

LANDIS TOOL CO., Waynesboro, Pa. Bulletin CB47, describing the 6-inch Type CH plain hydraulic grinder.....68

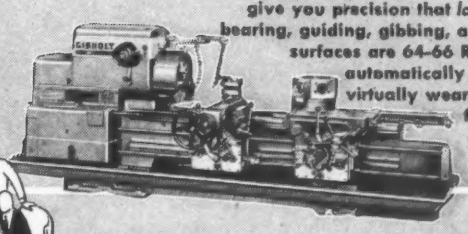
Pipe and Stud Extractor

REPS TOOL CO., INC., 94 Allyn St., Hartford 3, Conn. Folder describing extractors for removing broken pipe, studs, etc. 69

GISHOLT'S

Hardened steel bed ways are one of the greatest contributions ever made to precision machining on a turret lathe

GISHOLT TURRET LATHES give you precision that *lasts!* All load-bearing, guiding, gibbing, and clamping surfaces are 64-66 Rockwell C—automatically lubricated—virtually wear-proof. Write for literature



GISHOLT MACHINE COMPANY, *Madison 3, Wisconsin*

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly round parts. Your problems are welcomed here.

turret lathes • automatic lathes • superfinishers • balancers • special machines

News of the Industry

California

SURVEYS, INC., is a newly formed company with offices in Palo Alto, Calif., which will make available to educational and industrial organizations placement techniques, training services, job evaluation methods, and special economic surveys. DR. KEITH VAN ALLYN, president and director of research of the new company, was engaged for fifteen years in research on job elements and personnel qualifications for matching man and job under the sponsorship of the National Institute of Vocational Research, Inc. Associated with Dr. Van Allyn as vice-president and general manager is J. HERMAN MATTSON.

WILLIAM F. COLLINS, mechanical engineering consultant, is moving his office from St. Louis, Mo., to Los Angeles, Calif., after the first of the year. For the last two years, Mr. Collins has been engaged in research work connected with metal-cutting oils for the Socony Vacuum Oil Co.

JOHN SEAGREN has been appointed chief engineer of the Atlas Imperial Diesel Engine Co., Oakland, Calif. He was formerly chief engineer of the Diesel Engine Division of the American Locomotive Co., Schenectady, N. Y.

Illinois

JOSEPH A. WHITE, formerly general superintendent of the Columbia Steel Co., Pittsburgh, Calif., has been appointed works manager of the Chicago, Ill., plant of the Ingersoll Steel Division, Borg-Warner Corporation. MILO F. MCCAMMON, assistant works manager at the Kalamazoo Mich., plant of the company, has been promoted to the post of works manager. ROBERT S. INGERSOLL, who formerly served as works manager for both plants, will now be able to devote his full time to his duties as vice-president of the Ingersoll Steel Division, in charge of manufacturing at the Chicago, Kalamazoo, and Evansville, Ind., plants.

HUNT-JORDAN CO., has been organized at 1147 S. Independence Blvd., Chicago 24, Ill., to handle the exclusive representation of the resistance welding equipment built by the Progressive Welder Co. in northern Illinois and part of Iowa and Indiana. The company will also handle the sale of Knu-Vise toggle clamps in the same territory. DONALD F. HUNT, welding consultant, heads the new organization. W. H. JORDAN, his associate, was previously in charge of standard machine design for the Progressive Welder Co.

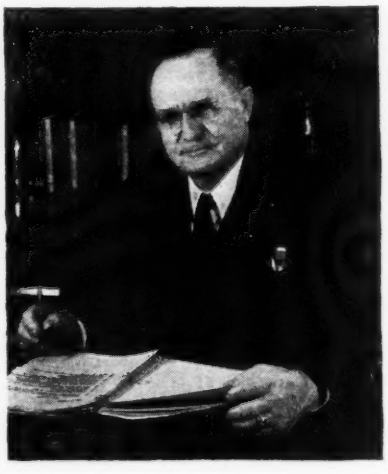
WEL-MET CO., Kent, Ohio, manufacturer of powdered-metal bearings and parts, has announced the appointment of RICHARD H. KHUEN, 820 S. Maple Ave., Oak Park, Ill., as regional sales representative. Mr. Khuen was formerly sales manager of the Chrysler Corporation's Powdered Metal Division and a member of the board of directors of the United States Graphite Co.

COLUMBUS BASILE has been made superintendent of the Caldwell plant of the Link Belt Co., located at 2410 W. 18th St., Chicago, Ill. LEONARD C. HEINLEIN has been appointed to the newly created position of assistant superintendent at the company's Ball and Roller Bearing Division plant in Indianapolis, Ind.

P. A. ANDERSON, Box 166, Lakeville, Conn., has been appointed eastern sales representative of the SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., and the BURGAN MACHINERY CO., 9527 Fifth Ave., Inglewood, Calif., has been named western sales representative.

GEORGE H. LYNN, Washington lathe sales representative for the Axelson Mfg. Co., Los Angeles, Calif., has resigned to accept the position of Western Division sales manager for the Niles Tool Works, with headquarters in Chicago, Ill.

LEE H. BENSON has joined the Tuthill Pump Co., Chicago, Ill., as vice-president in charge of manufacturing. Mr. Benson has had forty years of experience in the mass production field, having been connected with such organizations as General Motors, Westinghouse, and Willys-Overland.



Lee H. Benson, Vice-president in Charge of Manufacturing for the Tuthill Pump Co.

MINSTER MACHINE CO., Minster, Ohio, has announced the appointment of LUTHER & PEDERSEN, INC., 565 W. Washington Blvd., Chicago 6, Ill., as exclusive representatives for Minster power presses in the Chicago and Milwaukee territories.

Louisiana

INDUSTRIAL SALES CO., 339 Carondelet St., New Orleans, La., has been appointed factory representative of the BERGER MFG. DIVISION, REPUBLIC STEEL CORPORATION, Canton, Ohio, handling the Berger line of steel lockers, shelving, shop equipment, and storage cabinets.

Michigan and Wisconsin

ARSENEAU-PRICE CO., 10840 E. Warren, Detroit 13, Mich., has recently been formed to manufacture a complete line of standard straight-shank chucking reamers with straight and spiral flutes, from 1/8 to 1/2 inch diameter. The company will also manufacture special reamers, endmills, milling cutters, and counterbores of 1/2 inch diameter or less. Certain territories are available to manufacturers' representatives.

INDEX MACHINE CO., Jackson, Mich., has recently been formed to act as sales representative for the INDEX MACHINE & TOOL CO., of the same city, manufacturer of index milling machines and related equipment. The company's line was formerly handled by the BLANK & BUXTON MACHINERY CO., of Chicago. The officers of the new company are G. S. ADAMS, president; AXEL SWANSON, vice-president; and H. T. ANDRESS, secretary and treasurer.

LOVEJOY TOOL CO., INC., Springfield, Vt., has announced the appointment of BURLEIGH-STOCKER MACHINERY CO., 23675 Woodward Ave., Pleasant Ridge, Mich., as exclusive representative in eastern Michigan for Lovejoy metal-cutting tools. G. E. JONES, who has been representing the company in this territory, will have his office with the Burleigh-Stocker Machinery Co.

DETROIT BROACH CO., 20201 Sherwood Ave., Detroit 12, Mich., has

How the First All-Steel Welded Vise is Made

By H. F. Seymour, President
Columbian Vise & Manufacturing Co.
Cleveland 4, Ohio

WHAT is believed to be the first all-steel vise fabricated by arc welding is the Columbian Work Shop Vise shown in Fig. 1. This vise was redesigned in collaboration with Parsons Engineering Corp., welding specialists, from conventional construction to arc welded steel to achieve superior strength, accuracy and long life.

Basic material used is SAE 1020 hot rolled steel plate, punched and formed to the proper shapes. Fig. 2 shows the component parts. The base plate is $\frac{3}{8}$" thick,

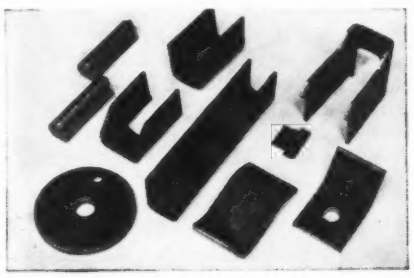


Fig. 2. Component parts of the vise.

the nose piece $\frac{5}{16}$" and all others $\frac{3}{16}$".

The first fabricating operation is the welding of the front, or sliding, half. The rail, T-blank, front body and jaw are assembled in a jig and tack-welded. In

Fig. 3. Welding front body to rail with inside fillets.

this same jig the front body is welded to the rail with inside fillets (see Fig. 3), and the nose piece tacked on.

This front half is then passed to the

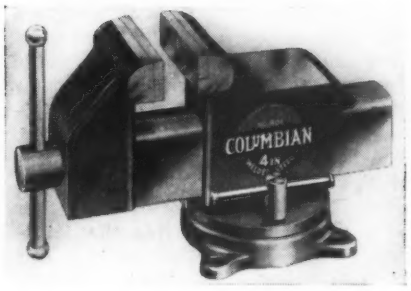


Fig. 1. The Columbian all-steel welded vise.

next welder, who makes the final fillets which join the nose piece and T-blank to the front body. The next operator welds the jaw to the nose piece.

Meanwhile, the rear half of the vise is being assembled in similar manner by another bank of welders. The rear body and swivel base are assembled in a jig and tacked together by the first man. The next man welds these parts with continuous fillets.

The front half and the partially-assembled rear half of the vise are then passed to a welder who fits them together. He inserts the sleeve, or inside guide, in the rear body, slides the rail of the front half through it, and welds the sleeve to the rear body with four 1-inch welds. Fig. 4 shows how the assembly is clamped in the jig. He then tack-welds on the rear anvil.

The vise then goes to the last welding operator, who welds the rear jaw to the anvil and the anvil to the rear body.

The vise assemblies are passed from one operator to the next by means of steel chutes.

Air hammers are used to peen the welds and clean off the spatter, and the welds are then ground smooth. Hardened steel jaw faces are drilled and counter sunk into the jaws. The screw and handle are forged steel and the malleable iron nut is replaceable.

AWS Type E-6030 electrode is used for welding the rear body to the base in

Fig. 4. Raising clamp which held inside sleeve for welding to rear body.

order to get a fillet with exceptionally deep penetration. For all other welds, E-6012 electrode is used.

With 12 set-up men and welders, 1,000 vises are produced a week. Production can be stepped up to 2,500 a week by increasing the force to 22 men.

Fig. 5. Making final welds—anvil to body, and jaw to anvil.

The above is published by LINCOLN ELECTRIC in the interests of progress. Machine Design Studies are available free to engineers. Write The Lincoln Electric Company, Dept. 41, Cleveland 1, Ohio.

announced the appointment of three new sales representatives: G. C. Wood Co., 613 Clark Bldg., 717 Liberty Ave., Pittsburgh 22, Pa.; William K. Nelson, 253 Plymouth Bldg., Minneapolis 2, Minn.; and C. H. Rodgers & Co., 705-6 Gerke Bldg., 123 E. 6th St., Cincinnati 2, Ohio.

McGill Carbide Tool Co. has been organized at 4612 Woodward Ave., Detroit 1, Mich., to manufacture tungsten-carbide tools. Charles C. McGill, founder of the concern, was formerly connected with one of the leading fabricators of tungsten-carbide tools.

Francis J. Sehn has been appointed sales engineer in the Detroit area for the E. W. Bliss Co. Prior to this appointment he was assistant master mechanic.

Chris. A. Wiepking has been appointed chief engineer of the Delta Manufacturing Division of the Rockwell Mfg. Co., Milwaukee, Wis. Previous to his present appointment he was research engineer for the company.

Chris. A. Wiepking, Newly Appointed Chief Engineer, Delta Manufacturing Division, Rockwell Mfg. Co.

New England

Louis J. Baudis has been appointed chief engineer of the Bullard Co., Bridgeport, Conn., and Robert W. Waring assistant chief engineer. Joseph C. Olson has been made head of the service and demonstration department. Mr. Baudis formerly served as development engineer and assistant to the vice-president in charge of manufacturing. Mr. Waring was previously chief engineer of a division of the Bridgeport Brass Co., and material and process engineer of the Sperry Gyroscope Co., Long Island. Previous to his present appointment, Mr. Olson was assistant to the works manager.

Raymond J. Southwell, Unity Road, Nichols, Conn., has resigned as sales manager of the Campbell Division of American Chain & Cable Co., Inc., to devote his time to a new process for manufacturing wire fabrics developed by Mr. Southwell. The new process involves equipment of new design that produces a non-woven fabric of wire bonded together with plastic which welds the joints and protects the wires against corrosion. Mr. Southwell will also engage in consultant work.

George N. Vitt has resigned as assistant to the president of the A. F. Holden Co., New Haven, Conn., to become secretary, member of the board of directors, and manager of the John Ek Industries, Inc., Guilford, Conn., manufacturer of heat-treating salt baths, furnaces, and automatic installations for various metallurgical processes, as well as internal combustion engines and several precision items.

Reps Tool Co., Inc., manufacturer of pipe and stud extractors, formerly located at 99 Wall St., New York 5, N. Y., has moved to 94 Allyn St., Hartford 3, Conn. All the manufacturing and other activities of the company will be consolidated at the new location.

Pratt & Whitney Division, Niles-Bement-Pond Co., West Hartford, Conn., has taken over the manufacture of the products of the Magnetic Gage Co., Akron, Ohio. This line includes continuous electrical gages for rolling mills, strip mills, and paper mills.

Ward Leonard Electric Co., Mount Vernon, N. Y., has established a New England office at 37 Webster St., Hartford 6, Conn. C. F. Shea, formerly connected with the sales engineering department at the home office, is district manager in New England.

Arter Grinding Machine Co., 15 Sagamore Road, Worcester, Mass., has purchased from the Grenby Mfg. Co., of Plainville, Conn., the rights to manufacture and sell the line of cylindrical and internal grinders previously made by that firm, which includes a combination external cylindrical and internal grinder, a multiple-spindle surface grinder, and a tap flute grinder.

Walter E. Winfrey Co., Cambridge, Mass., has been appointed representative in eastern Massachusetts, Rhode Island, New Hampshire, and Maine for the line of tungsten-carbide cutters, high-speed steel rotary files and cutters, and cast-alloy Woodruff keyslot cutters made by the M. A. Ford Mfg. Co., Inc., Davenport, Iowa.

Reed-Prentice Corporation, Worcester 4, Mass., has signed a contract to manufacture the Lithomat offset printing machine for the Lithomat Corporation of Cambridge, Mass.

Henry D. Sharpe has resigned his post as treasurer of the Brown & Sharpe Mfg. Co., Providence, R. I., a position that he has held since 1904. He will continue to serve as president of the company. Frederick P. Austin, Jr., assistant treasurer since 1941, has been elected to the treasureship and has been made a vice-president of the firm. Howard L. Merrill has been elected assistant secretary, succeeding the late Cecil W. Machon.

Brown & Sharpe Mfg. Co., Providence 1, R. I., recently showed several thousand people the same exhibit as was displayed at the Machine Tool Show in Chicago. The exhibit was re-erected in one of the buildings at the Providence plant and invitations were issued to all employes, their families and friends. The various machines exhibited were seen in actual operation.

E. S. Browne, Jr., has been appointed exclusive selling agent in Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island for the line of rotary surface, cylindrical, and internal grinders built by the Arter Grinding Machine Co., of Worcester, Mass.

New York and New Jersey

Carborundum Co., Niagara Falls, N. Y., announces the following appointments in its sales organization: W. T. McCargo has been named assistant director of sales in charge of operations in the western region, with headquarters in Chicago; John S. Hawley assistant director of sales in the central region, with headquarters in Cleveland; and John G. Fritzinger, assistant director of sales in the eastern region, with headquarters in Philadelphia. R. R. Huntington will fill the post of district sales manager at Philadelphia, previously held by Mr. Fritzinger.

Vice-Admiral George F. Hussey, Jr., U.S.N. (Ret.), wartime chief of the Navy's Bureau of Ordnance, has joined the staff of the American Standards Association (with headquarters at 70 E. 45th St., New York 17, N. Y.), and on January 1 assumed the duties of administrative head of that organization. He suc-

Sidney Lathes

● Power is evident in the massive, heavy construction of this Sidney 32-inch lathe. However, this illustration does not reveal the smooth flow of power and freedom from back lash developed by the Sidney Continuous Type Herringbone Geared Head—an exclusive feature pioneered and brought to its present efficiency by Sidney engineering. Here is a lathe capable of using carbide tools to their fullest efficiency. Add to this a wide range of feeds and speeds—operation made easy by centralization of controls—accuracy of work assured on all operations—and you have a dependable machine for your precision turning, facing, counterboring, threading, and similar operations.

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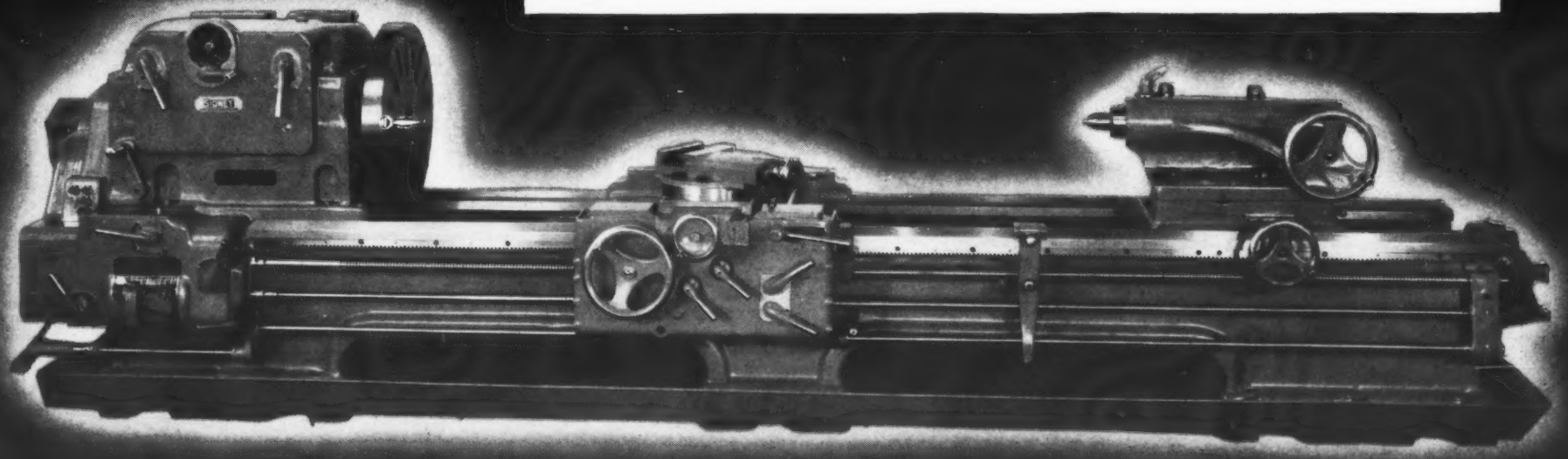

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Save PLANER and SHAPER Time With this STARRETT Precision Gage

Operators can make every first cut "on the nose" by setting planer and shaper tools with Starrett No. 599 Planer and Shaper Gage. Used with a micrometer or Vernier Caliper, it will gage with extreme accuracy within its range of ¼ to 6½ inches. Also serves as a universal height gage and gap gage. Alignment and parallelism of ends, sides and work contacts held to close limits — lateral play eliminated by angular slide ways. Note handy level.

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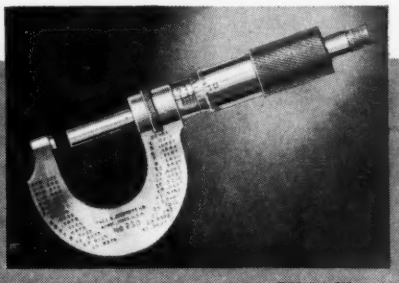
Leading shops rate STARRETT Vernier Tools high on their list of essential shop equipment. STARRETT Vernier Caliper No. 122 (shown above) is a sound, long-term investment in dependable, uniform accuracy. Sharp, clean-cut, easy-reading graduations; perfect workmanship, finish and balance — all guaranteed by the STARRETT reputation.



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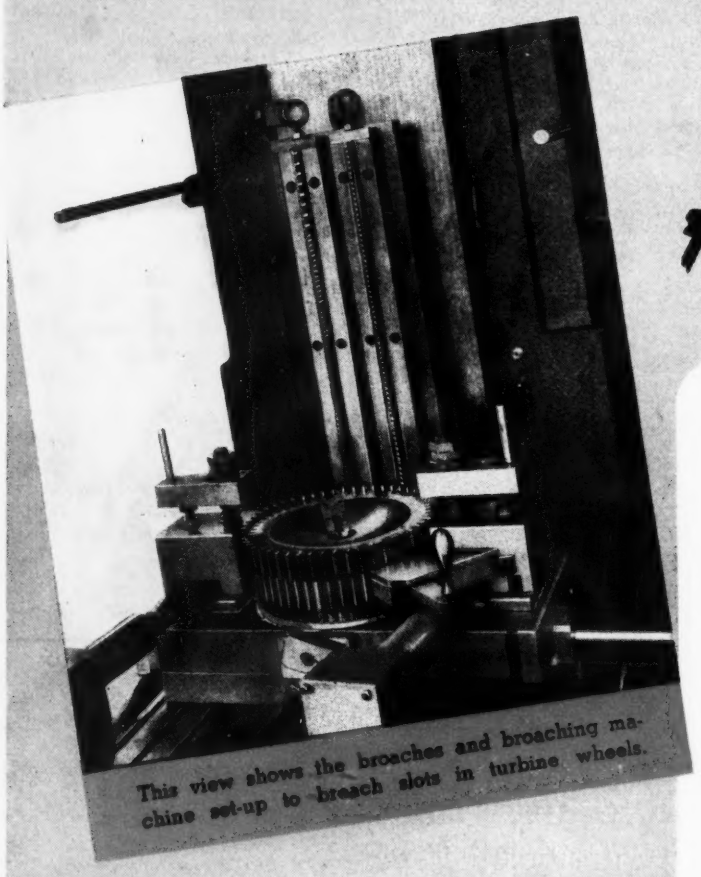
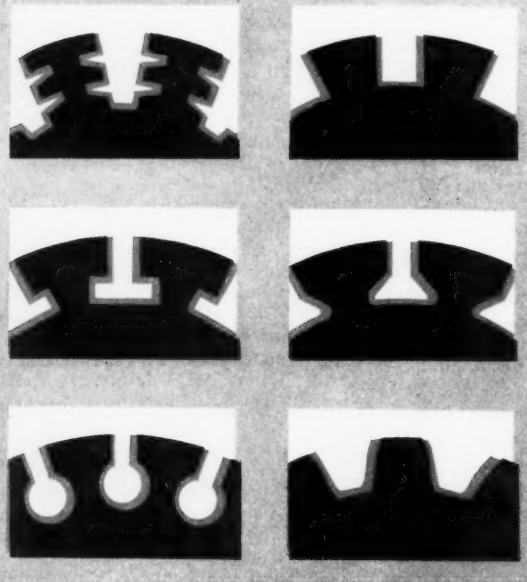
MACHINERY'S Data Sheet No. 602, January, 1948

Broaching PUTS TEETH IN THE JOB FASTER— For Less!



This view shows the broaches and broaching machine set-up to breach slots in turbine wheels.

SOME OF THE FORMS BROACHED



DETROIT BROACH COMPANY designed and manufactured the broach tooling to produce the slots around the circumference of many different turbine wheels. The result—perfect form, better finish and many more parts per hour than could be produced by any other method.

This application has led to others where slots, or teeth, are required around the outside diameter. In every case the savings in production costs have soon paid for the tooling. Further, the "human element" is practically eliminated when the job is broached.

Call the Detroit Broach representative in your locality now for real production savings—savings that will help to beat today's rising manufacturing costs.

DETROIT *Broach* COMPANY

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Vice-Admiral George F. Hussey, Jr., USN (Ret.), New Administrative Head of the American Standards Association

ceeds DR. P. G. AGNEW, who has served as secretary and head of the staff for the last twenty-eight years. Dr. Agnew will continue to give the Association the benefit of his services as consultant. CYRIL AINSWORTH, who for a number of years has been in charge of the technical activities of the Association, will serve with Vice-Admiral Hussey as director of operations of the staff.

DALC BEARINGS, INC., 1974 Broadway, New York, N. Y., has been organized to specialize in engineering application and sale of ball and roller bearings and other anti-friction products manufactured by the S K F, Fafnir, Federal, Schatz, and Timken bearing companies, and the Bunting Brass & Bronze Co. CLAYTON A. DECKER is president of the new firm, WILLIAM B. ASHLAND, vice-president, and RICHARD A. LAITINEN, secretary and treasurer. Both Mr. Decker and Mr. Ashland were previously associated with S K F Industries.

HARRY E. ORR, formerly general manager of operations of the Vanadium Corporation of America, 420 Lexington Ave., New York 17, N. Y., has been appointed assistant vice-president and manager of district sales of the corporation. He will be in direct charge of the Chicago sales district, with headquarters in Chicago. D. G. BOWSER, formerly metallurgical assistant to the executive vice-president, will succeed Mr. Orr as general manager of operations, and will be located at Niagara Falls, N. Y.

LAKE ERIE ENGINEERING CORPORATION, Buffalo, N. Y., has announced a change of its sales representatives for the states of Michigan and Ohio. These states will now be handled by RIEDER THORESON and FRED MCGOSH. Headquarters for the territory will continue to be located at 1115 Book Bldg., Detroit 26, Mich. The office will handle all of the company's general hydraulic presses, including those for the metal-working and process industries and for plastic molding.

AIRCRAFT SCREW PRODUCTS CO., INC., Long Island City, N. Y., has changed its name to HELI-COIL CORPORATION. The change in name was made because the firm's products are now used in many applications outside of the aircraft industry, and the present name is more closely tied up with the principal product—Heli-Coil screw thread inserts—of the company.

CALVERT CAREY has been elected president of the Yale & Towne Mfg. Co., with executive offices at Chrysler Bldg., New York 17, N. Y., succeeding the late W. Gibson Carey, Jr. FRED DUNNING has been elected executive vice-president of the company, and will continue to serve as secretary and treasurer.

ROBERT L. DEVITT has been appointed manager of the New York office, 50 E. 42nd St., of the Simmons Machine Tool Corporation, Albany, N. Y., succeeding WILLIAM WERLEY, who will handle sales in the southern territory. Mr. Devitt was formerly production manager of the company.

SAMUEL KOFFSKY, chief engineer of the Simmons Machine Tool Corporation, Albany, N. Y., has been named general manager of the Simmons Fastener Corporation. Mr. Koffsky will remain in charge of engineering of the parent company, with whom he has been associated for about fifteen years.

Samuel Koffsky, Recently Named General Manager of the Simmons Fastener Corporation

NORMAN L. DEUBLE has joined the metallurgical engineering staff of the Climax Molybdenum Co., New York City. For the last four years he has been with the M. W. Kellogg Co., Jersey City, N. J., in charge of special processes, and of the work in the high-temperature laboratory.

W. G. MILLER has been appointed assistant to the works manager of the Buffalo Division, Westinghouse Electric Corporation, Buffalo, N. Y. He was previously manager of the headquarters manufacturing staff in Pittsburgh.

JERRY M. GRUITCH has been appointed director of research and development for the American Car and Foundry Co., 30 Church St., New York 8, N. Y.

SPERRY PRODUCTS, INC., manufacturers of supersonic and electrical nondestructive testing and measuring instruments, announce that they will move their manufacturing plant and general offices from Hoboken, N. J., to Danbury, Conn., during the summer of 1948. The construction of a manufacturing building and a three-story office building will begin immediately.

Ohio

ARO EQUIPMENT CORPORATION, Bryan, Ohio, manufacturer of air tools, announces the following new appointments in the sales division: ROBERT SWAYZE, formerly of the factory sales office, has been appointed division manager in Texas, with headquarters in Dallas; HERBERT FREEMAN and MERLE MILLOR, JR., have joined the factory sales force; ED. E. ALLEN, has been appointed assistant to C. P. Enston, in the Cleveland territory; H. H. HIGGINS, has been appointed division manager in the Montreal territory; and VERNON C. LEIF has been appointed a member of the Los Angeles sales force.

ROBERT E. FORRESTER has joined the engineering department of the Parker Appliance Co., Cleveland, Ohio. He will assist in the design of aircraft fuel, and oil system components. Mr. Forrester was previously connected with the Koehler Aircraft Products Co. of Dayton, Ohio.

RELIANCE ELECTRIC & ENGINEERING Co., recently entertained about 5000 people upon the occasion of the opening of the company's new plant at Ashtabula, Ohio, which is now in full production on alternating- and direct-current motors and power units for Reliance V & S drives.

JOHN J. HARDING, president of the Massillon Aluminum Co., Massillon, Ohio, and a member of the executive committee of Ekco Products Co.,

Chicago, Ill., has announced his resignation effective February 1.

YODER DIE CASTING, INC., announces the opening of a new plant at 727 Kiser St., Dayton, Ohio, which will increase the company's facilities for producing die-castings.

JOSEPH T. RYERSON & SON, INC., Chicago 80, Ill., has recently completed new offices and a large addition to its warehouse facilities at E. 53rd St., and Lakeside Ave., Cleveland, Ohio.

H. A. PRATT has been appointed parts and service manager of the Davey Compressor Co., Kent, Ohio. He was formerly superintendent of the Kent plant.

DEROSS SALISBURY, JR., has been appointed abrasive field engineer in the Cleveland area for the Norton Co., Worcester, Mass.

Pennsylvania

VISUAL PLANNING EQUIPMENT CO., 6247 Broad St., Pittsburgh 6, Pa., is a new concern organized by HOMER H. DASEY, formerly president of Visual Production Planning, Inc., and his entire staff, for the design, promotion, and sale of three-dimensional planning equipment.

EDWARD L. HALLIN, JR., has been appointed machinery sales representative for JOSEPH T. RYERSON & SON, INC., Chicago, Ill. He will cover the Buffalo, Pittsburgh, and Cleveland areas, making his headquarters at the Ryerson steel service plant in Carnegie, Pa.

RAYBESTOS-MANHATTAN, INC., MANHATTAN RUBBER DIVISION, Passaic, N. J., has appointed P. L. EDWARDS assistant manager of its central district office in Pittsburgh. Mr. Edwards has been manager of the Products Division of the western district office.

* * *

Mason Britton Awarded Medal for Merit

Mason Britton, president of the Metal Cutting Institute, New York City, was presented on December 23 with the Medal for Merit, awarded by the President of the United States, for his outstanding wartime service in directing the increased production and distribution of machine tools vitally needed by industry and the armed services. The Medal for Merit is the highest civilian award bestowed by the President, and corresponds with the Distinguished Service Medal, which is awarded only to military personnel.

Obituaries

Oscar M. Polk

Oscar M. Polk, chairman of the board of directors of the Sheffield Corporation, died suddenly on November 22 of a heart attack. His death occurred two days before his seventy-first birthday. Mr. Polk was born in Dayton, Ohio, and spent his entire life there. In 1914, he became associated with the City Machine & Tool Co., which later was known as the Cimatool Co. In 1933, he became interested in the Sheffield Machine & Tool Co. of Dayton, which was reorganized the following year as the Sheffield Gage Corporation, with his son, Louis Polk, as vice-president and general manager of both Sheffield and Cimatool. The two companies were merged to form the Sheffield Corporation in 1941, with Louis Polk as president.

Oscar Polk also founded the National Broach Co., of Detroit, but disposed of his interest in that business a number of years ago. At the time of his death, he was chairman of the board of trustees of the Sheffield Foundation and a director of the Threadwell Tap & Die Co., Greenfield, Mass. Mr. Polk was also prominent in civic and banking circles, and had served as president of the Fidelity Building Association since 1931.

The survivors of Mr. Polk include his widow, Mrs. Elizabeth Polk, three sons—Louis, Albert, and Paul—and three daughters—Mrs. Milton Wagner, Jr., Mrs. Rodney Boren and Mrs. Stanley Bevis.

Alfred J. Marchev

Alfred J. Marchev, president of the Aircraft Screw Products Co., Inc., Long Island City, N. Y., died at his home in Garden City, Long Island, on November 28, at the age of fifty-one years. He had been president of the Republic Aviation Corporation during the war and retired last May as chairman of the board of that company to become president of the Aircraft Screw Products Co.

Mr. Marchev was born in Zurich, Switzerland, where he received his education as a mechanical engineer. Prominent as an inventor, he had more than five hundred patents in his name. Early in his career in this country, he occupied important engineering and management positions with the Thomas Morse Aircraft Corporation, the Ithaca Gun Works, and the Western Electric Co. In 1926, he founded the Temple Radio Corporation and became president of that concern. Five years later, he was appointed chief engineer and works manager of Ditto, Inc., and later held similar positions with the Signode Steel Strapping Co.

Mr. Marchev was a former chairman of the executive committee of the Aircraft Manufacturers' Council, eastern region, a former member of the board of governors of the Aircraft Industries Association of America, a member of the Society of Aeronautical Engineers, and an associate fellow and forum director of the Institute of Aeronautical Sciences.

BRADFORD FOOTE, SR., president and treasurer of the Brad Foote Gear Works, Cicero, Ill., died on November 19 after a short illness. Mr. Foote was born on April 16, 1872 in Chicago. He became a machinist's apprentice at the age of thirteen, and shortly after he was sixteen entered the gear business with his two brothers, founding the Foote Brothers Gear & Machine Co. In 1924 he organized the Brad Foote Gear Works to manufacture cut gears and speed reducers. Mr. Foote is survived by his widow and a son.

HAROLD B. GAYLORD, Philadelphia sales manager for the Carpenter Steel Co., Reading, Pa., died on November 26. Mr. Gaylord had been associated with the Philadelphia branch of the company for more than thirty years.

D. J. SULLIVAN, SR., chief tool engineer of the National Twist Drill & Tool Co., Rochester, Mich., died on November 16.

Coming Events

JANUARY 12-16—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

JANUARY 12-16—Second NATIONAL MATERIALS HANDLING EXHIBITION in the Public Auditorium, Cleveland, Ohio. Those interested can obtain further information from Clapp & Pollak, Inc., 350 Fifth Ave., New York 1, N. Y.

JANUARY 13-14 — Special national session of the Materials Handling and Management Divisions of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Cleveland, Ohio, with headquarters at the Hotel Statler.

JANUARY 26-30—Winter meeting of the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS in Pittsburgh, Pa. For further information, address the Institute at its headquarters, 33 W. 39th St., New York 18, N. Y.

(Concluded on page 250)

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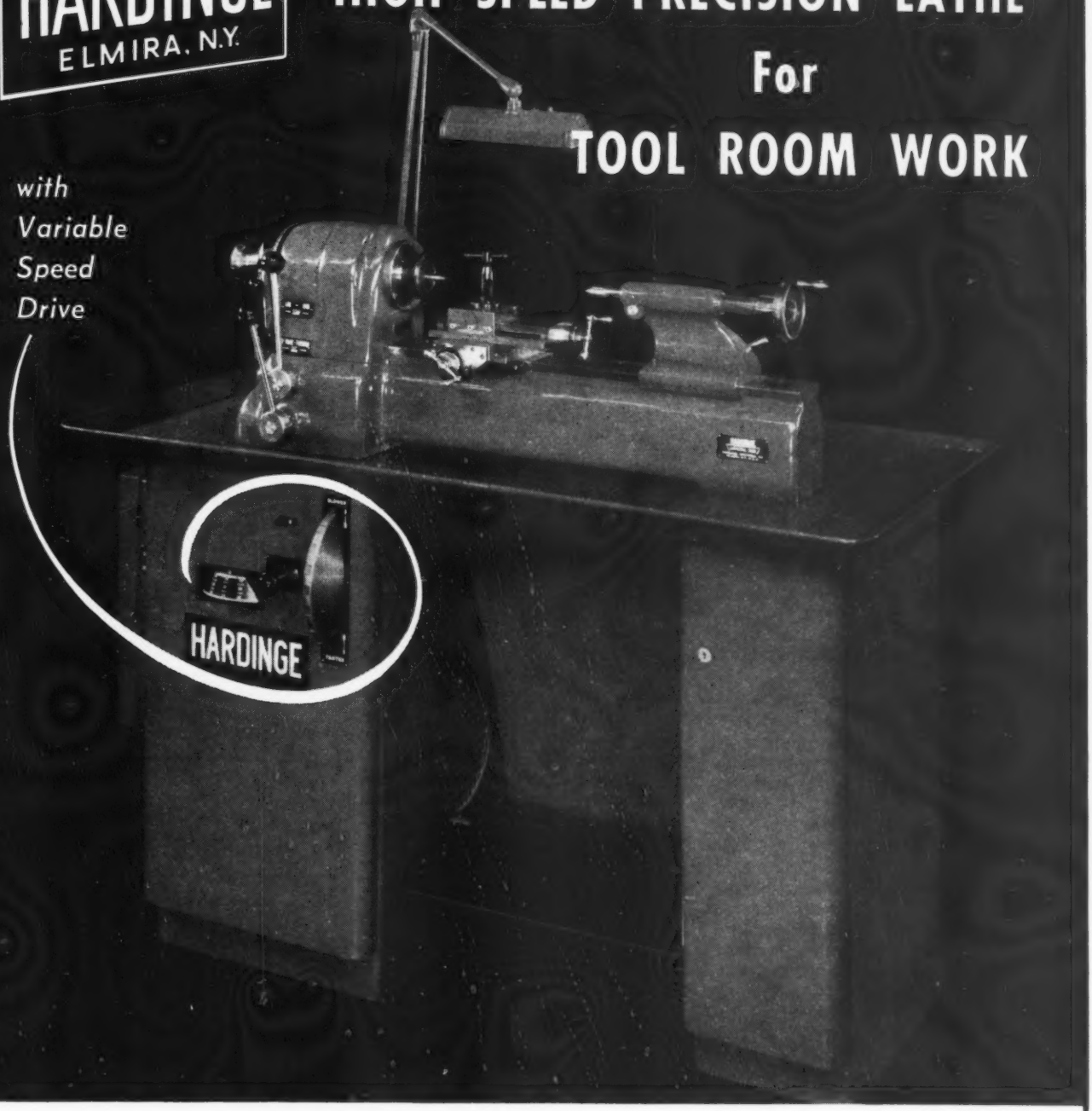
HIGH SPEED PRECISION LATHE For TOOL ROOM WORK

with Variable Speed Drive



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FEBRUARY 10-11 — Annual meeting of the PRESSED METAL INSTITUTE at the Hotel Statler in Buffalo, N. Y. For further information, address the Institute, Union Commerce Bldg., Cleveland 14, Ohio.

MARCH 15-21 — Sixteenth annual meeting and Tool Exhibition of the AMERICAN SOCIETY OF TOOL ENGINEERS in Cleveland, Ohio. Harry E. Conrad, executive secretary, 1666 Penobscot Bldg., Detroit 26, Mich.

MARCH 18-19—Fourth annual meeting and exhibit of MAGNESIUM ASSOCIATION at the Pennsylvania Hotel, New York City. Further information can be obtained from the Association, 30 Rockefeller Plaza, New York 20. N. Y.

MARCH 22-24—CHICAGO PRODUCTION SHOW and TECHNICAL CONFERENCE at the Stevens Hotel, Chicago, Ill., under the sponsorship of Chicago Technical Societies Council, 53 West Jackson Boulevard, Chicago 4, Ill.

APRIL 5-8 — THIRD SOUTHERN MACHINERY AND METALS EXPOSITION at the Atlanta Municipal Auditorium, Atlanta, Ga. Further information can be obtained from the Exposition offices at 267 E. Paces Ferry Road, N.E., Atlanta 5, Ga.

APRIL 5-8—Fourth annual conference and exhibition of the NATIONAL ASSOCIATION OF CORROSION ENGINEERS at the Jefferson Hotel in St. Louis, Mo. Chairman of the publicity committee, W. Z. Friend, 67 Wall St., New York 5, N. Y.

APRIL 26-30—SEVENTEENTH ANNUAL PACKAGING EXPOSITION in the Public Auditorium, Cleveland, Ohio, under the sponsorship of the American Management Association. For further information, address Clapp & Poliak Inc., 350 Fifth Ave., New York 1.

New Books and Publications

WORK AND EFFORT—THE PSYCHOLOGY OF PRODUCTION. By Thomas Arthur Ryan. 323 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, $4.50.

A systematic survey of psychological investigations on the productivity of men and women is given in this book. Among the problems treated are training and learning, the control of accidents, establishment of pay levels for various jobs, and the design of efficient methods of work. Motivation of the worker is considered in its relation to problems of efficiency. The book presents conclusions drawn from research in various fields. These include a study of the factors of light, heat, and ventilation; the control of monotony and fatigue; and the provision of conditions that make for maximum output without excessive effort or fatigue.

The information given is based upon reliable experimental and statistical techniques, so that facts may be provided for the use of industrial managers and supervisors, personnel directors, and psychologists—in other words, for all concerned with the setting of standards, with installing merit rating and job evaluation systems, and with improving the morale and efficiency of workers.

1947 GUIDE BOOK AND DIRECTORY FOR THE METAL-FINISHING INDUSTRIES (Sixteenth Edition). 436 pages, 5 1/4 by 7 7/8 inches. Published by the Metal Industry Publishing Co., Inc., 11 W. 42nd St., New York 18, N. Y. Price, $1.50.

This Guide Book and Directory, combining the sixteenth edition of the Plating and Finishing Guide Book, and the sixth edition of the Metal Finishing Buyers' Directory, contains information on electro-plating and allied subjects. Abrasive methods of polishing, buffing, and tumbling; cleaning and pickling of various metals; solutions employed for various types of electroplating; surface treatments, such as anodizing, coloring, silvering, and electrolytic polishing; control and testing of plating solutions; and organic finishing methods are some of the subjects presented. Chemical tables and a comprehensive directory arranged by product classifications and trade names are also included.

PROBLEMS IN DRAFTING AND DESIGN. By F. L. Goff. 117 pages, 6 3/4 by 10 1/4 inches. Published by McKnight & McKnight, 109-111 W. Market St., Bloomington, Ill. Price, $1.

A group of fifty problems in industrial drafting and design, including orthographic and pictorial drawings, is given in this book. The problems, which deal largely with the aircraft industry, have been selected to provide the information needed by the beginner and to acquaint him with drafting fundamentals, so as to enable him to develop skill in drafting techniques. The book has been prepared to assist the drafting instructor in organizing classes.

MAGNETIC CONTROL OF INDUSTRIAL MOTORS. By Gerhart W. Heumann. 589 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.50.

This work provides an exhaustive treatment covering electric motor performance, characteristics of control devices and functions of commonly used control circuits. Written especially from the application point of view, the book should be of particular value to industrial application engineers, design and operating engineers, plant and maintenance engineers, and teachers of motor applications and motor control courses.

HOW TO RUN A LATHE. 128 pages, 5 1/8 by 8 inches. Published by the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind. Price, paper-bound, 25 cents; leatherette-bound, $1.

The latest information on the operation and care of metal-working lathes is presented in the forty-fifth edition of this little handbook. Among the subjects covered are the operation of the lathe units, grinding cutter bits, making accurate measurements, plain turning, chuck work, taper turning, boring, drilling, reaming, tapping, and cutting screw threads.

HEAVY FORGED HAND TOOLS. 22 pages, 5 3/4 by 9 inches. Published as Simplified Practice Recommendation R17-47 of the United States Department of Commerce. Sold by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price, 10 cents.

FILES AND RASPS. 24 pages, 5 3/4 by 9 inches. Published as Simplified Practice Recommendation R6-47 of the United States Department of Commerce. Sold by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price, 10 cents.

DIAMOND CORE-DRILL FITTINGS. 18 pages, 5 3/4 by 9 inches. Published as Commercial Standard CS17-47 of the United States Department of Commerce. Sold by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C. Price, 10 cents.

ELECTRIC RESISTANCE WELDING — A BIBLIOGRAPHY OF THE LITERATURE FROM JANUARY, 1936 to JUNE, 1947. By Harold S. Card. 22 pages, 8 1/2 by 11 inches. Published by Harold S. Card, 850 Euclid Ave., Cleveland 14, Ohio. Price, $1.

A.S.T.M. STANDARDS ON COPPER AND COPPER ALLOYS. 462 pages. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $4.